

May 6, 1968

NOTES  
MR. GERMAN'S COPY

5-6-68

*With comments - none  
marked for DEP-A.*



# R&D OPERATIONS

*Mr. Newby*

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
DEP-A	Mr. Gorman			
	1968 MAY 16 PM 3 30			

*DHn*

## REMARKS

The enclosed weekly note from A. R. Felix, R-AERO-AE, to Dr. Geissler confirms the position you took when the consensus outside of MSFC was that Reynolds number effects presented no problems.

Thanks to your concurrence in the acquisition of the High Reynolds Number test equipment, we are in a position to make early contributions to the solution of suspected problems in this area.

*R. W. Cook*  
R. W. Cook

MAY 14 1968

1 Enc:  
As stated

CODE	NAME	DATE

MSFC - Form 495-1 (October 1963)

*1.2 w/ky  
Notes  
5/9*

DEP-A ACTION TO

INFO COPY

*Gorman, Newby*

WEEKLY NOTES, R-AERO-AE, MAY 9, 1968

High Reynolds Number Test Equipment:

Recently a considerable amount of interest has been shown in our High Reynolds Number project by AEDC and Boeing. Both of these organizations are conducting serious studies in this area and are quite interested in the design details of our hardware. The AEDC studies are further along than Boeing's and we know that they are leaning toward a test section size in the 10-foot range (as compared to our 32-inch).

At the recent Supersonic Tunnels Association Meeting at the Naval Ordnance Laboratory further confirmation of the need for increased Reynolds number testing capability came to light. Several aircraft companies (Lockheed-Georgia, McDonnell-Douglas, Boeing, and North American) presented in a panel discussion some specific instances of lack of agreement between wind tunnel test data and flight data in the Mach number range between 0.7 and 1.0. It was felt that in several of these cases the problem could well be a Reynolds number effect caused by lack of simulation of flight Reynolds numbers.

A. R. Felix

cc:

DIR, Mr. Shepard

R-OM-P, Mr. Read

RECEIVED DEP-A

1968 MAY 16 PM 3 29

# OFFICE OF DIRECTOR - MSFC

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
Connie:				
	<i>John</i>			

REMARKS

The attached notes are considered sensitive.

Please return when Mr. Styles has finished with them.

Thanks,  
Jean

RECEIVED DEP-A

1968 MAY 28 AM 9 19

CODE	NAME	DATE



NOTES 5-6-68 KUERS

5/6/68

Mr. Styles  
for info

B5/2

ME Laboratory Internal Information Program: In November 1967, we initiated this program in ME Laboratory as a result of the studies of Dr. Tompkins and Mr. Richetto from Purdue University which revealed a need for improvement of communications mainly from Division level down to the first line supervisors. The objective of the program is to improve the team spirit in the organization, to enhance the feeling of participation of all supervisory personnel in our challenging programs, and to improve the awareness of responsibilities for building flight hardware. ✓

Shep  
Suggest we  
follow this  
example in  
all labs  
and offices  
B

As a first phase of the program, we established short weekly meetings of all supervisors with their groups of personnel, in which the technical aspects of our programs and Marshall Center policies and management guidelines are discussed. The discussions in these groups are aided by Information Memoranda for dissemination of up-to-date technical information. The results of these brief group meetings, in which our project engineers often participate, are very encouraging. ✓

The second phase of the program will consist of a training program of all supervisors in "Management by Objectives", a course which will emphasize the techniques of communication between supervisors and their groups in order to improve the understanding of our goals and the important role of the Marshall Center in the space flight program. The training courses have been discussed with Mr. Dowdy from the Training Branch and the first courses will start soon. ✓

A third phase is being planned to open the lines of communication in the ME Laboratory, so that everyone in the Laboratory may see me or Dr. Siebel personally on matters related to our work and our organization. ✓

1. a  
w/ bly  
Note  
5/6/68

NOTES 5-6-68 KUERS

5/6/68

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for info  
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1.2  
W. K. K.  
Notes  
5/6/68



May 10, 1968

THS

5/10

✓ 1. MANAGEMENT OF MSFC PHYSICAL SPACE

The draft instruction covering this subject was circulated April 10.

Replies have been received from staff offices only; I. O. & R&DO replies are overdue. Most staff offices and Industrial Operations have submitted the

required floor plans and current occupancy data. R&DO elements have not. A status report on this action is being prepared for Mr Newby.

*J. H. Powell*  
J. H. Powell

1.2.  
w/ply notes  
5/10/68

1968 MAY 16 AM 9 38

RECEIVED DEP-A

# R&D OPERATIONS

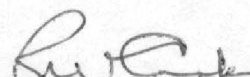
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DEP-A	Mr. Gorman			

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DIR, Mr. Shepard

R-OM-P, Mr. Read

RECEIVED DEP-A

1968 MAY 16 PM 3 29

*1.2  
5/9/68  
Wkly  
Notes*



NOTES 5/6/68 BALCH

5/6 JTB

B 5/P

S-II-3 Arrival at MTF - Stage arrived at MTF at 7:30 p.m., Sunday, 5/5/68. Receiving and depackaging operations are almost complete. Preparations are under way for LH<sub>2</sub> tank entry for Propellant Utilization probe rework and X-rays. Current schedule calls for installation in stand on 5/12/68, "power up" on 5/19/68, cryogenic proof-pressure test on 6/6/68, removal from stand on 6/13/68, and shipment to KSC on 6/26/68. ✓

S-II-4 Testing - Stage was installed in the Vertical Checkout Building on 5/2/68 and is to be removed on 5/7/68 and prepared for shipment to KSC, which is now definitely rescheduled from 5/25/68 to 5/11/68. ✓

S-II-5 Testing - Cryogenic proof-pressure test was successfully accomplished on 4/30/68. The LH<sub>2</sub> tank was vented at 36.205 PSIG, thereby meeting the requirement. Static firing has now been postponed to 7/10/68, primarily because of requirement to install modified fuel line in the Auxiliary Spark Ignition system. ✓

S-IC-6 Testing - Additional testing is planned as a result of the SA-502 flight, but no firm test schedule is yet available. Tentative plans still indicate that test activities will be resumed late this month. ✓

Legal Affairs - Three damage suits against the Government have been filed in Federal Court in Biloxi, Mississippi, seeking awards totalling \$17,500.00 for damages allegedly caused by the static firing of the S-IC-5 stage at MTF on 3/25/67. Plaintiffs in the three suits are Otho, James, and Larry Rester, whose claims were denied by MSFC. Attorney for the Resters in these suits is Mr. Michael D. Haas of Bay St. Louis, Mississippi. Information has been received from Mr. Haas that MSFC has been furnished a copy of the Complaint. ✓

Public Affairs - A feature story on the MTF Safety Program has been prepared for the Marshall Star. The story will also be released to public news media this week. ✓

During the month of April 1968, there were 3,400 visitors to MTF, almost double the number of visitors during April 1967. ✓



5/6/68

LM-A MOCKUP: A "walk through" of the LM mockup was held at Grumman on May 2-3, and will be followed by the Preliminary Requirements Review on May 7, 8, and 9. We understand that Dr. Mueller has signed a request to Mr. Webb for extension of the LM-A effort through September. MSC has reviewed an updated control and display panel layout and Martin will provide us with marked-up drawings this week showing the MSC suggestions. ✓

MID-TERM PRESENTATION: A mid-term presentation of the progress made on the "Study of Requirements for a Biotechnology Laboratory for Manned Earth Orbiting Missions" was given by McDonnell Douglas Corporation, Huntington Beach, at NASA Headquarters. This study is being funded by OART. The study is essentially on schedule with the final report planned for distribution about August 10, 1968. A representative of this office attended the presentation. ✓

MDC/ST. LOUIS SUPPORT TO MDA TASK FORCE STUDY: McDonnell Douglas Corporation, St. Louis, has been participating with MSFC in the conceptual design for integration of earth-looking experiments on the AAP-2 Airlock. On May 2, 1968, they reported status of their conceptual design efforts.

We generally agree that all optical experiments will be located inside the pressure vessel looking through windows at the earth, and that all radiation experiments would be external to the pressure vessel. Mounting of the radiation experiment on an Airlock truss appears to be most advantageous. Systems support (data management and environmental control) are immediately available. ✓

MDC preliminary design input will continue to be supplied until a new baseline is established for hardware implementation. ✓

MANPOWER AT MARTIN MARIETTA CORPORATION: Direct manpower at Martin has been frozen at the level on April 4, 1968. The level is 523, with 430 on payload integration and 93 on ATM controls and displays. New manpower ceilings have been provided to each of the I-S/AA Managers. We are proceeding on the assumption that the level for payload integration will continue through December 1968. Also, we are proceeding in coordination with the Saturn I Workshop and MDA Managers to transfer to MDC all work presently at Martin on these two projects. A phasing is being developed to provide an orderly transfer of this work. ✓

PAYLOAD INTEGRATION: It is suggested a complete review of Martin's AAP effort (by Martin) be conducted in the near future. In that their effort for the past one and one-half years has been primarily oriented to support our in-house work, it is hard for Center management to get a feel for what they are doing. To allow use of this output relative to reassignment of management responsibilities, the review should be conducted soon. ✓

L.B.

Yes. Let's  
discuss  
timing  
and  
details  
B



NOTES 5-6-68 BROWN

B 5/8

F-1 ENGINE The turbopump primary fuel seal on AS-503 Engine F-4023 was found to be leaking 420 SCIM (specification allowable leakage is 50 SCIM). Attempts to reduce the leakage by rotation of the pump have been unsuccessful. It now appears the most likely course of action is to replace the engine with a spare engine which is available at MTF. We are presently working the problem with KSC and our opinion is that it can be accomplished without schedule impact. ✓

Twenty-five percent of the teflon seal in the GSE tail service mast, LOX dome purge quick disconnect was missing when the system was disconnected on AS-503. Small (1/4" x 1/4") pieces of the seal were removed from engine injectors positions one and four. Further inspections of the system are planned in an effort to locate the remainder of the seal (a piece 3/4" x 1/4" x 1/32"). ✓

Dr. E. W. Larson of Rocketdyne, visited MSFC last week for discussions on the MSFC and Rocketdyne POGO Test Programs. Engine F-4028 was shipped to EFL on May 3, 1968, for an initial series of six tests to determine the effect of helium injection on engine steady state performance and stability. ✓

J-2 ENGINE In accordance with the telephone conference with General Phillips on May 2, 1968, a special Quality Control Team has been formed to review J-2 engine Quality Control with special emphasis on 205 and 503. This team which will be headed by the Quality Laboratory will meet May 6 at MSFC and begin the review at Rocketdyne later in the week.

Testing of the improved ASI lines is continuing at Rocketdyne. Also, the new lines have been installed at AEDC. In addition, verification testing at MSFC is scheduled to begin this week. ✓

5/6 JS

B 578

Use of MAF for "Other Work"

CCSD has been awarded two contracts for other work during this reporting period. One ~~co~~contract was for a "National Space Booster Study," issued by NASA Headquarters in the amount of \$904,636. The second contract was awarded by MSFC for an "Electrostatic Zero Growth Work Table" in the amount of \$42,834. ✓

NOTES - 5/6/68 - EVANS

5/6/68

B5/4

Details  
already  
given in  
4/22/68  
Notes

A Safety survey of the Marshall Space Flight Center is scheduled for May 7 - 9. The purpose of this survey is to review the MSFC Safety and accident prevention program to include the safety functional management organization, documentation, and the industrial safety and spaceflight accident prevention efforts. ✓

An outline of the plan for the three days is as follows:

Tuesday, May 7; 1:30 p.m. to 5:30 p.m. introductory briefing

Wednesday, May 8; 8:30 a.m. to 4:30 p.m., tour and survey

Thursday, May 9; 8:00 a.m. to 12:00, survey team draft report

12:00 to 4:30 p.m., survey team exit briefing ✓

NASA conducted a Government/Industry System Safety Symposium at Goddard Space Flight Center on May 1, 2 and 3, 1968. Mr. Neubert and Dr. Mrazek attended on May 1 only. Approximately 15 other MSFC representatives attended for the full three days. ✓

The System Safety Network Technical Interchange meeting was convened at FOB # 10B in Washington on April 30, 1968 and conducted by Drs. Mrazek and Farish. The events were routine. ✓

NOTES 5/6/68 FELLOWS

5/6 JS

B518

BOB Budget Reform Activities: Attached (your copy only) is a copy of April 12, 1968, Bureau of the Budget Bulletin 68-9, "Planning-Programming-Budgeting (PPB) System" which contains the latest guidance to agencies for continued development of integrated PPB Systems and which outlines requirements for PPB submissions to the Bureau. I acquired the Bulletin in Washington last week and have given the original to Woody Bethay for Executive Staff use because formal distribution has not yet reached the Center. The principal objective of the PPB System is to improve the basis for major program decisions by identifying program issues and considering such issues in the framework of a program structure. The PPB System has three basic elements:

1. Program Memoranda (PM's). A PM presents a statement of the program issues, a comparison of the cost and effectiveness of alternatives for resolving those issued in relation to objectives, the agency head's recommendations on programs to be carried out, and the reasons for those decisions. PM's, therefore, provide the documentation for the strategic decisions recommended for the budget year.

2. Special Analytic Studies (SAS's). The Special Analytic Studies provide the analytic groundwork for the decisions reflected in the PM's.

3. Program and Financial Plans (PFP's). The PFP is a comprehensive multi-year summary of agency programs in terms of their outputs, costs, and financing needs over a planning period covering the budget year and four future years, or a longer period if this is appropriate to agency programs. While PM's deal primarily with the resolution of specified program issues, PFP's provide a continuing record from year to year of the outputs, costs, and financing of all agency programs. Thus the PFP is the basic planning document of the agency PPB system. ✓



NOTES 5/6/68 GEISSLER

B578

5/6/68

Gravity Substitute Workbench Experiment: A prototype aerodynamic workbench has been designed and an RFP has been issued for critical hardware fabrication and procurement. The aerodynamic workbench is part of the gravity substitute experiment proposal M-507. The objective of this experiment is to investigate the feasibility and utility of non-inertial gravity substitution schemes (aerodynamic and electrostatic force fields) to aid Astronauts in handling parts and assemblies under "zero g" conditions. Aero-Astrodynamic Laboratory is principle investigator for the aerodynamic bench, Chrysler is principle investigator for the electrostatic version, and ME Laboratory is in overall charge of experiment development. ✓

1. F-1 ENGINE PROGRAM: Engine F-4023, installed on S-IC-503, exhibited excessive fuel turbopump primary seal leakage. Leakage was found to be 450 s.c.i.m., maximum allowable is 50 s.c.i.m. The pump was rotated several times in both directions and leakage was not reduced. A sample of 39 engines processed through MSFC was evaluated and the maximum leakage noted was 21 s.c.i.m. It is our recommendation that the engine be replaced.
2. ECA PACKAGES: During the latter part of March, we were notified of a systems failure occurring on AS-503, which was traced to a malfunction in the J-2 ECA package. This malfunction was subsequently traced to a cracked solder connection at the PC board/Elco Connector mating. Recall and repair of other ECA packages disclosed many similar cracks. This Laboratory has completed tests and evaluations to determine the predominant cause/mechanism of the cracking, and evaluation and selection of a suitable repair method. It is planned that all ECA units will be recalled, examined, and repaired. ✓
3. S-IC STAGE B NUTS: Testing for incorrectly heat treated tubing assembly B nuts has been completed on S-IC-9. Nineteen tube assemblies had to be replaced. S-IC-7, the last vehicle remaining to be checked, has undergone partial examination with twelve noncompatible assemblies found. The balance of this check will be made at MTF. ✓
4. VEHICLE SYSTEMS FAILURE ANALYSIS: The presentation on Vehicle Systems Failure Analysis was made April 30, 1968, to reliability and quality assurance personnel of NASA Headquarters. The presentation was apparently well received and all comments, suggestions, and observations were constructive in nature. Some of the more significant comments were: expand the base to include Saturn V and Pegasus failure information, publish the nomenclature dictionary as a NASA publication, and combine the failure data base with the PRINCE/APIC data. Each of these areas had previously been considered, and preliminary efforts toward these objectives have been initiated to a limited degree. ✓



1. ATM Film Retrieval. Front end film retrieval is used for the two NRL experiments which utilize folded optics in their design. All other experiments use the LM-end common work station for film retrieval whereby the canister is rotated to achieve accessability for each of the film cameras. For the front end retrieval, the physical spacing does not allow a "50 percentile" astronaut to reach the camera handle and a longer handle presents removal problems. A telescoping type of handle may be the solution to the problem. Mockups and KC135 zero g tests are planned to verify the selected design in July/August. ✓

2. Harvard College Experiment (HCO-C). Since this experiment was the last to be introduced in the ATM-A, its definition and contractual coverage has been lagging the other experiments. Last week, we held an interface meeting with HCO and American Science and Engineering (the hardware contractor) and significant progress was achieved. We anticipate to have the hardware for this experiment under contract in the near future pending some minor clarifications concerning the interface definition. ✓

S-1B (MSFC) Stage S-1B-11 was removed from the Static Test Tower East on May 3, 1968. Stage S-1B-12 arrived over the weekend and will be installed in the Static Test Tower East on May 6, 1968. ✓

S-11 STRUCTURAL TEST PROGRAM The S-11 (V7-21) stage will be delivered to R-TEST Wednesday, May 8, 1968. ✓

S-11-5 (MTF) A successful cryogenic proof pressure test was performed on S-11-5 on April 30, 1968. The static firing mode sequence test was not performed due to GSE problems. The acceptance static firing is scheduled for July 10, 1968. ✓

F-1 ENGINE Preparations were made for test FW-080 at the West Area F-1 Test Stand. The test is tentatively scheduled for May 9, 1968, and will be the first of a series of POGO tests to investigate the S-1C POGO problem experienced during the 502 flight. ✓

S-1VB (MSFC) Test S-1VB-058 was conducted on April 30, 1968, using the J-2 engine S/N J-2050, for a duration of 6.48 seconds. The test was planned for 75 seconds duration, however, it was cut short because of an erroneously calibrated redline parameter. The first attempt to fire was aborted at engine start command when the lox prevalve failed to reach the open position within the 4 seconds required. This is a flight sequence for the S-1VB stage and is presently being investigated as to cause and solution. ✓

ARM 9 - ACCESS ARM Modified environmental chamber for Arm 9 was shipped from KSC via Guppy on April 26, 1968. Strain gauge instrumentation was immediately installed and chamber was assembled to arm structure on May 1, 1968. Test Stand arm installation was started on May 2, 1968. Checkouts of environmental chamber should start May 8, 1968. Presently, we see no problem in meeting completion date of July 18, 1968. ✓

F-1 TURBOPUMP At the request of P&VE, we are preparing the F-1 Turbopump Facility for a series of tests to evaluate proposed fixes on the POGO problem encountered during S-1C powered flight on AS-502. Certain facility mods were required to meet the test objectives. Mods are being accomplished and it is anticipated that the POGO testing will begin on or about May 14, 1968. ✓

J-2 AUGMENTED SPARK IGNITION (ASI) TEST The J-2 thrust chamber was fired two times at CTL last week with ASI. The first test established baseline or normal thrust chamber - ASI operating conditions. After reaching mainstage on the second test, the ASI mixture ratio was increased from 0.94 to 7:1 to simulate ASI fuel line rupture. This resulted in ASI throat burnout which also penetrated the main fuel passages in the center of the thrust chamber injector. There was no damage to the main thrust chamber although the chamber ran for approximately 25 seconds. ✓

One additional test is planned on Tuesday at a mixture ratio of 10:1 to determine if the additional lox will cause burn through to the lox passages in the main injector. ✓

B 5/8

NOTES 5-6-68 HOELZER  
2/6 KLS

ACCEPTANCE TESTING OF THIRD GENERATION COMPUTER SYSTEM: Acceptance testing is continuing on Phase I of the UNIVAC 1108 computer system. Acceptance testing was temporarily suspended on April 24, after a complete series of tests had been run. Trouble reports were submitted to UNIVAC for corrective action, and testing was resumed on April 30 with considerable improvement noted in the system. At this time, the mean time between system failure appears to be approximately 50 minutes. Multiprogramming has been successfully accomplished during several periods of time, ranging up to two hours. The number of programs being multiprogrammed is still limited to two. Moderate success was realized in batch-processing from remote stations, operating three stations simultaneously (two 9300's and one 9200). Attempts to use a basic graphic display from a remote station have thus far been unsuccessful. It is quite evident at this time that we have not yet entered a successful 30-day acceptance performance period. We will keep you posted on improvements in the performance of the systems. ✓

NOTES 5/6/68 JOHNSON

5/6/68

B 5/8

Nothing of significance to report.



5/6/68

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NOTES 5-6-68 LUCAS

B 5/12

5/12 NB

1. J-2 ENGINE ASI ASSEMBLY TEST: A test was done on 5-3-68 at MSFC Test Laboratory on the J-2 engine thrust chamber and ASI assembly. The objective of the test was to simulate a leak in the ASI fuel line during the test, thus causing the ASI to shift in mixture ratio from one to twelve. The duration of the test was stand capacity (28 seconds). During 27 seconds of this test, the ASI was operating at a mixture ratio of approximately 5-7 and this did cause damage to the fuel side of the injector and burning progressed almost into the LOX post. Had the duration been longer or had the ASI mixture ratio of 12 been achieved, it is believed that the burning would have progressed into the LOX injector side also. Since this type of burning into the injector fits well with what is believed to have happened in the S-II engine No. 2 failure, it is important that this be confirmed by tests. A subsequent test is planned for this week using the MSFC test facility (R-TEST).✓
2. ORBITAL WORKSHOP THERMAL VACUUM TEST: As a result of our meeting with MSC on 4-10-68, the MSC facility group has completed a preliminary study of the Space Environment Simulation Chamber "A" modifications which would be required to undertake the S-IVB Orbital Workshop thermal vacuum test. The salient point brought out in this study was an estimated cost of \$3,000,000 required for facility modifications, the major portion of which was for the thermal simulator consisting of lamps, support stand, and reflector. R-ME Laboratory has been contacted about the possibility of building the support stand in an effort to reduce total cost.✓
3. X-15 SPRAY FOAM EXPERIMENT: Films from the recent X-15 flight with spray foam applied to the speed brakes were viewed on 4-30-68. The flight simulated the effects of the S-IC boost on the spray foam insulation. There was some erosion of the foam as expected, but the results indicate that the foam is acceptable for the Saturn V flight.✓
4. ORBITAL WORKSHOP (OWS) COLOR SCHEME: The OWS mockup has been modified to incorporate the Raymond Loewy Inc. recommended color scheme. At the present time, tests are being conducted to determine what effect this color scheme has on illumination. Any resulting changes in lighting requirements shall be reflected in future test plans. Incorporation of the integrated Loewy-Snaith color scheme is contingent upon obtaining acceptable colors in finishes compatible to the OWS environment, and emissivities consistent with thermal control requirements. MDC is to propose color attainments within design limits to MSFC on 5-7-68. It is apparent that some decrement will be required in close color match in order to meet engineering requirements.✓
5. CENTAUR PROGRAM: Personnel from the Lewis Research Center visited last week for discussions on spray foam insulation. General Dynamics/Convair also has discussed spray foam insulation with North American Rockwell. Apparently, the Centaur insulation problems are not completely resolved.✓

NCTES 5/6/68 RICHARD

5/6/68

B 5/6

GSE Improvement Study: This week we are giving George Hage, MSF, a brief status report on our Saturn V GSE studies aimed at reducing launch count delays, etc. This activity was started at the request of General Phillips, and it will also support I-V-E in their response to KSC, MSF, etc., on the same subject. We will discuss the approach we've taken to date and some specific details on possibilities in the electronic systems area. ✓

This briefing is important at this time so that this effort doesn't get lost in all of the AS-502 emphasis. We have not yet reached agreement with KSC or internally on exactly which options we will proceed with, or the exact timing, but it is important to keep MSF aware of our efforts and the fact that we are on the move in this area. As this activity firms up, we will arrange a briefing for you. ✓



5/6 XLS

B-512

FY-69 BUDGET STATUS: The House passed by voice vote a bill authorizing a total NASA budget of \$4.032B on Thursday, May 2. The changes from the recommendation of the House Committee are shown below:

	1 NASA Request	2 Authorization Committee Recom.	3 $\triangle$ (1-2)	4 Authorization Bill	5 $\triangle$ (2-4)
AO	\$648.2	\$646.7	\$1.5	\$603.2	\$43.5
AAP	439.6	395.6	44.0	253.2	142.2
Total	4,370.4	4,217.3	153.1	4,031.4	185.9

The House Appropriations Committee recommended the same amounts as contained in the House Authorization Bill with the exception that C of F was reduced by \$23.2M bringing the NASA total to \$4.008B. Efforts are being made to include the NASA Appropriations in the House floor debate on the Independent Offices Appropriation Bill next week. This will require a waiver of House Rules since there is no final Authorization Bill. ✓

TECHNICAL PLANNING MECHANISM STUDY: Mr. Donlan on his May 2nd visit to MSFC asked that we prepare information in response to the following questions:

1. Define what can be done with the resources available under the minimum base study. (i.e., what is the technical output of \$400 million per year for MSFC or 1 billion per year for MSF). ✓

2. To what extent would the CORE Program effect the results of 1? ✓

MINIMUM BASELINE STUDY: Messrs. Kubat and Koenig met with representatives from MSFC, MSC and KSC at Marshall on May 1 and 2 to review the first cut results of the Minimum Baseline Study. Each Center had amplified and supplemented the MSF guidelines, but in general, there were no insurmountable differences in the Center's approach.

A meeting is scheduled for May 7 at MSC to review these results with General Bogart and the Center Administrative Deputies.

The minimum baseline requirements (FY-72) for each Center are shown below:

	<u>Funding</u>	<u>C. S. Manpower</u>	<u>Support &amp; Prime Contractor Manpower</u>
MSFC	\$408M	6505	7283
MSC	380M	4617	4960
KSC	204M	4436	6238

✓



NOTES 5/6/68 RUDOLPH

5/6/68

B 518

1. General: We received a call from KSC early this morning and were informed that Adm. Middleton's only son was killed in a traffic accident in New York over the weekend. (Adm. Middleton has two daughters.) The funeral will probably be held on Wed., 8 May 68.

2. S-II Stage Material Problem: A presentation was given to Gen. Phillips on Wed., 1 May 68, at which time we proposed to replace all spec-063 aluminum (defective new material) with spec-021 aluminum (same as used on earlier stages). In addition, we will take all necessary action to insure that none of the stress corrosion susceptible material is used in flight stages. By utilizing overtime, the only impacts to present schedules will be 1 1/2 weeks on S-II-10 and 7 1/2 weeks on S-II-11. Gen. Phillips reconfirmed his previous verbal approval of this plan. ✓

3. POGO: Mr. Hellebrand (P&VE) and Mr. Murphy (Saturn V) will meet with the engineers from Aerospace Corporation and TRW (who worked the Titan-Gemini POGO problem) to definitize the area where these contractors can assist, (particularly verifying the space vehicle math model). Martin-Denver personnel are already working in-depth with our people. ✓

o The full POGO working group will meet on Wed., 8 May 68, and a complete review of the problem with George Hage (MSF) is scheduled for Thurs., 9 May 68. ✓

4. Hardware Modification: On Fri., 3 May 68, a meeting was held with R-QUAL, KSC and Contractor representatives and it was determined that any hardware mods installed after manufacturing checkout would be subject to review to insure that complete retest, reverification and reinspection was accomplished. This is a common approach with the Saturn IB; and we are moving as rapidly as possible to get these instructions to our contractors. The full cooperation of KSC must be obtained in order for this endeavor to succeed. ✓

5. LOX - Propellant Filtering at KSC: On Mon., 29 Apr 68, Dr. Debus called and requested that we take a complete look at all LOX and fuel filtering systems in use at KSC to assure that the total systems are adequate; and to consider the possibilities of placing additional filters in the stages, if required. My Systems Engineering Office has initiated this investigation with P&VE Lab. ✓

NOTES - 5/6/68 - SPEER

5/6/68

1. MISSION D PRESENTATION: The presentation you requested on Mission D is now scheduled for May 9 at 2:00 p.m. in the Tenth Floor Conference Room.
2. AS-503 D MISSION: There is a possibility, because of the distance limitations of the VHF telemetry systems, that some flight control data needed for third burn and passivation may not be obtainable. The S-Band telemetry system on the IU is the prime system during this time period and contains the majority of the required data. We have examined, along with Astrionics, the impact of rechannelizing the remaining measurements from the S-IVB VHF link to the IU S-Band link and have concluded that the required rechannelization would have a major impact on both the vehicle and the ground network and cannot be implemented. We are hopeful, however, that the RF analysis presently being conducted by Astrionics will confirm the reception of the VHF data during the questionable time phase.
3. MISSION IMPLEMENTATION PLAN (MIP): Captain Holcomb presented to MSFC plans for a new document which will control such things as detailed test objectives, operational tests, an outline of the flight plan, etc. We understand that OMSF will issue the MIP six months prior to launch and that most items will start being controlled at F-3 months. In working with both Saturn Program Offices, we feel that there is no real need for this additional control device since all L/V related items to be covered have always been concurred in or approved by OMSF. However, OMSF is determined to proceed with the first issuance (Apollo 7) and we will submit constructive comments.
4. FLIGHT OPERATIONS STUDIES: We have reached basic agreements with the R&D laboratories and the stage project offices on management plans for the Flight Information and Operations Studies being conducted by MDC and IBM. These studies are to identify systems malfunctions for which corrective action onboard or from the ground can be identified. The principal element will be an ad hoc working group chaired by F. Kurtz of this office.
5. OPERATIONAL SUPPORT SYSTEMS STATUS REVIEWS: General Stevenson is conducting a review of each of the Operational Support Systems during the next month. The first review will be held on May 9 at KSC and will cover the KSC support systems and the HOSC. The review of the other systems is scheduled for June 12 at MSC, again including contributions from our side. Summaries of the Stevenson reviews will be presented at the DCR's on June 6 and July 11, respectively.

NOTES 5-6-68 Stuhlinger

5/6 J/S  
1. VISITORS FROM OART: Messrs. Duff Ginter and Andy Anderton from OART, during a visit to this Center on 5/2, spent two hours at SSL. They were interested in three subjects: (1) status of optical technology work; (2) capability and availability of segments of this Center for scientific and technological inhouse work; and (3) our thoughts regarding advanced technologies to be developed for future science-type space payloads. We had the feeling that our presentations were received with great interest.



NOTES 5/6/68 TEIR

5/6/68

SA-205 STATUS: During the past week the inspection of the IU was completed and the S-IVB forward skirt was removed and inspected. Present status is generally as follows: Our primary concern on the IU was cabling but cable inspection and laboratory tests on the cabling have shown the IU in a posture for restacking by May 10, 1968. Total fix included neutralization of the surfaces and changeout of four cables plus detailed inspection and teardown of about four or five of the most suspect connectors. With the exception of running continuity tests and mega-checks on portions of the cabling, the S-IVB forward skirt electrical inspection is complete. At this time there is no changeout of cables or connectors planned. Approximately eighty huckbolts (tying the skirt stringers to the skirt aft mating flange) have been removed and inspected as a result of discoloration on the bolthead, and only one or two had evidence of corrosion on the shank of the bolt. After neutralization and passivation of this area the huckbolts will be replaced with new ones. Several nut plates on the skirt forward mating flange will also be replaced. Present plans call for stacking forward skirt on May 9.

No further actions have been required on the S-IB stage.

LAUNCH INTERLOCK CONTROL DOCUMENT: Reference is made to Ludie Richard's notes of April 15, 1968 (copy attached) concerning the Apollo Crew Safety Review Board's recommendation that a center interlock control document be prepared, implemented, and controlled at the program manager's level. We have had an effort underway since mid-January to prepare such a document and have coordinated this action with the laboratories concerned. G. E. has been given the task of preparing the document and it should be available for final coordination within two or three weeks.

Q-BALL TRANSDUCERS: Reference is made to my notes of March 25, 1968 (copy attached) concerning the success of Rosemont Engineering Company (REC) in improving the transducer welds. At this time two of three Q-balls equipped with the improved REC transducers for testing have successfully passed all required qualification testing and one of these has passed all required reliability testing. All Q-ball testing should be completed by the end of this month.

NOTES 4/15/68 RICHARD

4/15/68

B 4/16

Apollo Crew Safety Review Board Activity: The John Hodge Board is progressing through the Saturn Apollo System in the traditional fashion of probing for soft spots. These activities sometimes take the form of questioning decisions which, at the time of their making, were not totally accepted by everyone.

Launch interlocks are being questioned in depth, particularly as they may have evolved in accord with guidelines and component or sub-system failure history at the time of implementation, which may not be applicable today. A general case in point is that at one time pad or near pad abort of the spacecraft was considered safer than it is today in the light of unquestionable hazard associated with land landing.

Another Board activity has resulted in the recommendation that a Center interlock control document be prepared, implemented and controlled at the program manager's level. This activity has tentative management agreement but still requires both Saturn IB and Saturn V approvals.

A special group of MSC and MSFC people will be convened to examine the functional systems interface between spacecraft and launch vehicle. This investigation will go beyond the interface all the way to the beginning of the system which causes that interface. It is the intent that this group will not be inhibited by one center's regard of the right of privacy of the other center on its side of the interface.

Since this is the first Crew Safety Board, the Board will attempt to document its activity and findings so that "the next" Board on crew safety can start its activity from a recorded baseline. ✓

Varlow  
2. File

NOTES 3/25/68 TEIR

Q-BALL TRANSDUCERS: Rosemount Engineering Company has finally succeeded in improving the welds in their differential pressure transducers used in the q-ball to the extent that ME, Quality and Astrionics laboratories are pleased with the result. A sample of the last six welds was inspected by ME laboratory a few days ago and declared to be of excellent quality. What is really encouraging is that it now appears that Rosemount has developed their technique to the extent that they are now producing welds with repeated quality. They delivered the first four of sixteen transducers for requalification tests ahead of schedule last Thursday. They should deliver four per week beginning April 5. The fifth set of four is scheduled to go to Chrysler for installation in the flight q-ball for AS-205. If this schedule is maintained, it will permit delivery of the q-ball six weeks prior to launch. It is desirable to follow this arrangement for two reasons; first, it will permit some early retesting prior to installation of the new production transducers in the q-ball, and second, it will permit calibration just prior to shipment. Recalibration is required each six weeks.

FILTORS, INC. RELAY: We use the Filtor relay in the S-IB stage and in the IU. This is the relay which recently had the problem of a plug used during a soldering operation falling through the port causing subsequent shorting or blocking of operation. We have tested a large number of relays without experiencing the plug problem. In addition, all of our flight critical circuits using the relays have built-in redundancy and we do not expect a problem.

INSTALLATION OF SA-206 MOD KITS IN VLF 37B: You may hear that we are installing SA-206 mod kits in VLF 37B even though the SA-206 LM-2 mission has been canceled. We have recommended, and KSC has agreed, that the SA-206 update mod kits be installed in VLF 37B to bring the configuration of the facility as alike VLF 34 as possible and to reduce turnaround time for the next launch from VLF 37B.



NOTES 5/6/68 WILLIAMS

5/6/68

1. OTES Program: Mr. Ginter and Mr. Anderton, Headquarters, OART, visited MSFC, May 2, 1968, in connection with the Optical Technology Program. They were given briefings and demonstrations in the Optical Technology area at the Space Sciences Laboratory and at the Astrionics Laboratory, and were briefed by Advanced Systems Office on program management.

Mr. Ginter has already sent \$300K to MSFC for new work in Optical Communication and at the conclusion of the visit agreed to send \$500K for new work in Telescope Technology (Parallel to the Optical Communication Work); \$300K for SRT in Optical Technology which would be spent for a "Real Time Figure Sensor" (Mirror Surface Measurement), and a "Deformable Mirror with Actuator."

Mr. Ginter is still inclined to have MSFC manage the Optical Technology Program. He plans to do some preparatory work at Headquarters prior to taking final action in concert with MSFC in the management area.

2. CCSD "National Space Booster Study": Dan Schnyer met with the Study Team at MSFC on 4/30/68, and discussed the background and scope for the study, and described plans for organization of the Study Team. OSSA, OART, KSC, and MSC were represented in addition to MSF and MSFC. IO, R-AS, R-AERO, R-ASTR, and R-P&VE representatives have been named to represent MSFC on the Study Team.

The orientation meeting with CCSD is scheduled for the week of 5/13/68, probably at Michoud. This will give us a better indication of what MSFC support will be required for the study.

3. Special Launch Vehicle Working Group: Milt Rosen has called a meeting in Washington on May 7. He hopes to plan the next two months activity, define the studies required in more depth, and make assignments for carrying out the jobs.

Bill Huber (MSFC representative) has had several discussions with IO and Executive Staff on this matter. We are trying to use the updated Apollo Cost Study and the Institutional Minimum Base Study to answer as many of Rosen's questions as possible. It is important to define the guidelines to be used for Rosen as compatible as possible with those being used in the above studies. Bill will attempt to eliminate and combine certain of the Rosen studies to minimize the additional work required.

C. Mathews has established a working group in Headquarters (MSF) to support Les Fero, and in turn, Rosen. Bill will meet with him to establish how we are all going to function.

May 13, 1968



NOTES  
MR. GORMAN'S COPY

MAY 13 1968

*With comments*

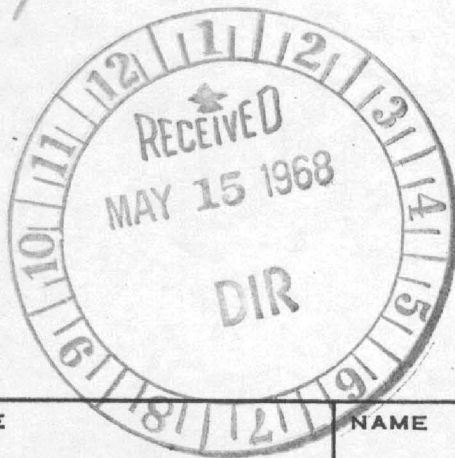
*(none marked DEP-A)*

# OFFICE OF DIRECTOR - MSFC

CODE	NAME	INIT.	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
	<i>Mr. Shepherd</i>			
	<i>Central file</i>			
	<i>D</i>			

## REMARKS

Maybe it doesn't bother you but these notes are being crammed so full of abbreviations lately that it is hard for a country boy to understand the message whatever became of the "four letter word" approach?



*Heurby*  
5-15-68

CODE	NAME	DATE

2342

7-18 84 7/1/68

GEORGE C. MARSHALL SPACE FLIGHT CENTER  
HUNTSVILLE, ALABAMA

*direct STS 7/19*

## Memorandum

NOTES

TO Dr. von Braun, DIR *B 7/18*

DATE JUL 10 1968  
In reply refer to:  
I-E-F-68-217

FROM Manager, Engine Program Office, I-E-MGR

SUBJECT von Braun Notes 5-13-68 (*cyatsh*)

As reported previously, abnormal gas generator (GG) oscillations had occurred during four of the first five tests on F-1 engine F-4028 at RETS. Leakage (GOX vapor) was noted from the gas generator oxidizer ball valve during chilldown prior to the fifth test, and the valve was replaced following this test. Later inspection revealed the seal retainer, shown on Enclosures 1 and 2, was torqued to 240 in-lb instead of the specified value of 325-350 in-lbs. Rocketdyne has concluded the leakage occurred due to inadequate load on the NAFLEX seal between the ball assembly and housing, and was caused by low torque resulting from gas generator oscillations on four tests.

Following replacement of the gas generator ball valve with another (#2) the gas generator oscillations did not recur. Tests were then conducted using the original ball valve (#1), as shown in Enclosure 3, Column 4, with the proper torque on the seal retainer. This explains the "increasing" torque which you questioned on June 29, 1968. Later tests have now been conducted with reduced torque values on the retainer, even to the point of duplicating the previously observed leakage, with no further gas generator oscillations noted.

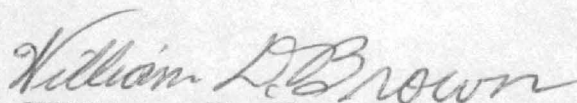
At the present time Rocketdyne has completed all testing on F-1 engine F-4028 until the turbine manifold and LOX inducer are replaced. No additional instances of gas generator instability occurred. Rocketdyne's present position is that the gas generator oscillations do not appear to be associated with helium injection. At the present time neither Rocketdyne or MSFC pretend to understand the mechanics of gas generator oscillations.





I-E-F-68-217

Production support engine F-106-3 is currently being tested with the helium accumulator system at RETS. No adverse affects have been noted. These tests will provide data to support the POGO Working Group Meeting scheduled for July 11, 1968.

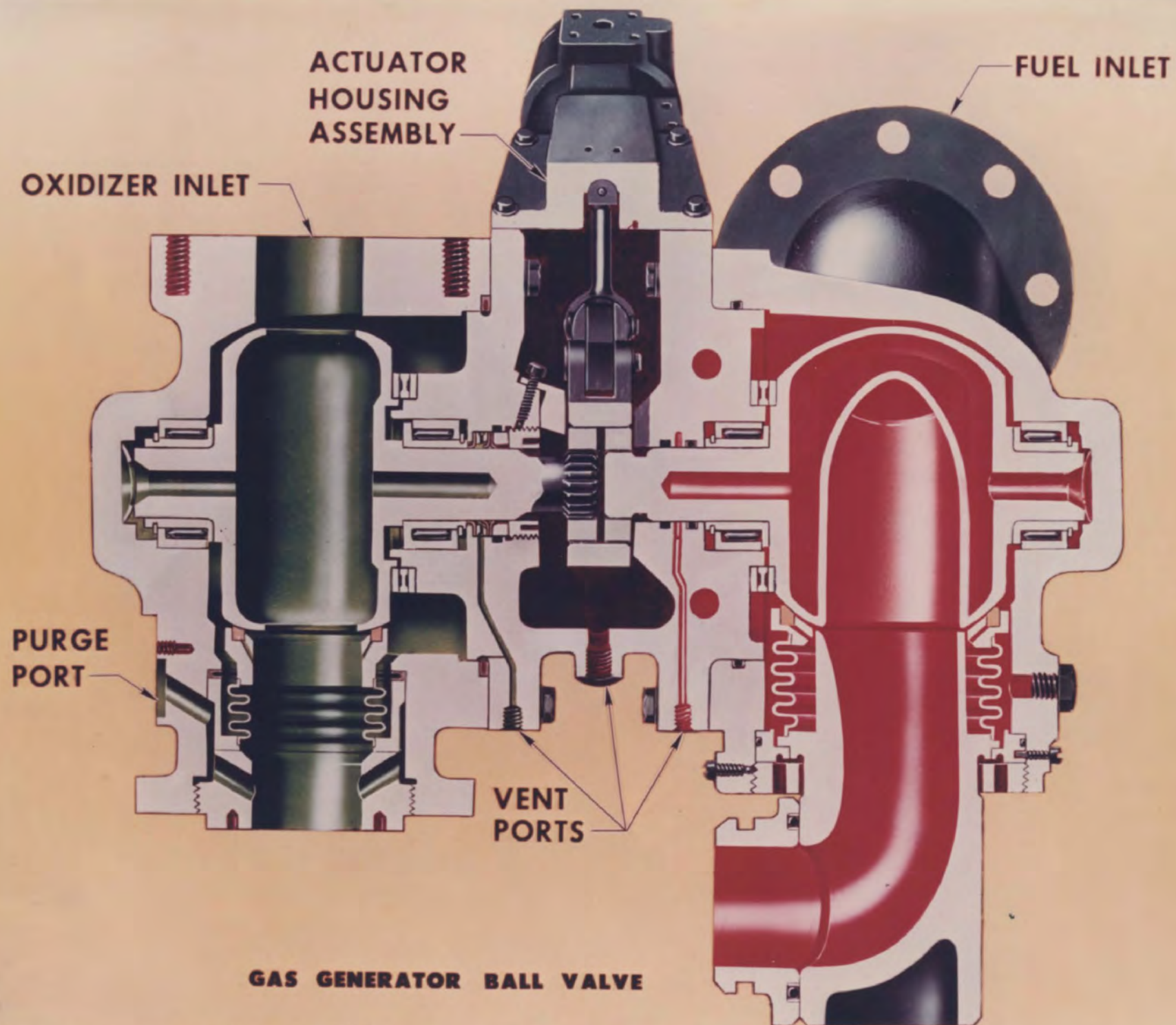
  
William D. Brown

5 Enc:

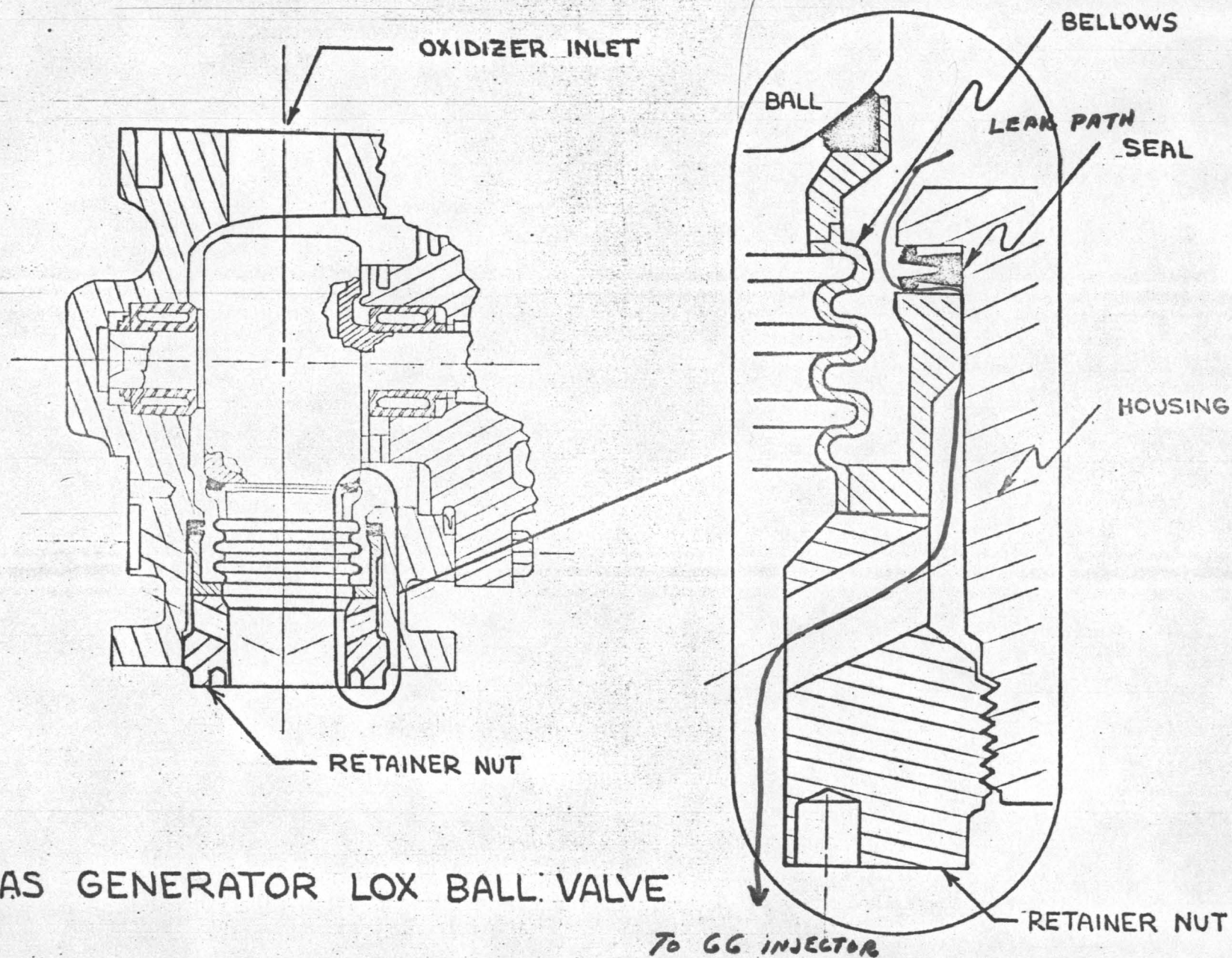
1. Figure 1, Gas Generator Ball Valve Schematic
2. Figure 2, Gas Generator LOX Ball Valve Schematic
3. Table 1, Summary of F-4028 Tests
4. June 20, 1968 Memorandum I-E-MGR to DIR
5. von Braun Notes, 5-13-68

cc:

I-E-F, Mr. Stewart









14 JUNE 1968

5

## SUMMARY OF F4028 TESTS TO DATE

TEST NUMBER	DATE	DUR.	BALL VALVE NUMBER	MAX. GG OSCILLATION AMPLITUDE	BOMB DAMP TIME	INJECTION			PULSING	LOX INLET PRESSURE
						GAS	PERCENT	LOC.		
436-023	5-7	168	1	>150		He	0.5,1.0, 1.5,2.0	20'	NO	107
-024	5-10	168	1	375		He	0.5,1.0, 1.5,2.0	20'	NO	107
-025	5-13	40	1	≈75		DNA	DNA	DNA	NO	45
-026	5-14	168	1	>150	NO	He	0.5,1.0, 1.5,2.0	20'	NO	107
-027	5-14	168	1	120	43	He	0.5,1.0, 1.5,2.0	20'	NO	67-127
-028	5-16	2	2	---		OBJECTIVES NOT MET				
-029	5-17	168	2	≈75		DNA	DNA	DNA	YES	107
-030	5-20	168	2	≈75	18	He	0.5,1.0, 1.5,2.0	20'	NO	47-107
-031	5-21	168	2	≈75	21	He	0.5,1.0, 1.5,2.0	20'	NO	67-127
-032	5-23	168	2	≈75		He	1.0,2.0	20'	YES	107
-033	5-27	168	1	≈75		He	1.0,2.0	31'	YES	107
-034	5-29	168	1	≈75		GOX	3.0	3.5"	YES	107
-035	6-3	168	1	≈75		He	0.5,1.0, 1.5,2.0	20'	NO	107
-036	6-7	168	1	≈75		He	0.8,2.4, 4.0,6.4	20'	NO	107
-037	6-11	168	1	≈75		He	≈1.5	20'	NO	107

3 JULY 1968

SUMMARY OF F4028 TESTS TO DATE

TEST NUMBER	DATE	DUR.	BALL VALVE NUMBER	MAX. GG OSCILLATION AMPLITUDE	BOMB DAMP TIME	INJECTION			PULSING	LOX INLET PRESSURE
						GAS	PERCENT	LOC.		
436-038	6-19	160	1	≈75		He	≈1.5	20'	NO	107
-039	6-20	167	1	≈75		He	≈1.5	Boot- strap	NO	107
-040	6-25	163	1	≈75		He	≈1.5	Boot- strap	NO	107
-026	6-14	160	1	≈75		He	≈1.5	20'	NO	107
-027	6-15	160	1	≈75		He	≈1.5	20'	NO	107



2331

GEORGE C. MARSHALL SPACE FLIGHT CENTER.  
HUNTSVILLE, ALABAMA

Memorandum

TO Dr. von Braun, DIR ✓ *B4/23* DATE June 20, 1968

FROM Manager, Engine Program Office, I-E-MGR

SUBJECT von Braun Notes 5-13-68

The following information is presented in answer to your question on the 5-13-68 notes about the possibility of gas generator instability caused by helium injection. Four out of the first six helium injection tests made on F-1 engines at the Edwards Rocket Engine Test Site resulted in excessive gas generator (GG) oscillations. The present specification limit on GG oscillations is 150 psi peak to peak and values on the four tests mentioned ranged from 120 to 375 psi. Normal oscillations are in the 60-75 psi range. Helium was injected at rates varying from 0.5 to 2.0% by volume of the LOX flow. No gas generator oscillations have been noted during helium injection in engine system testing at MSFC.

The excessive GG oscillations have not been duplicated by increasing the torque on the GG ball valve seal retainer, changing ball valves, changing the point of injection, or changing engines.

It was noted that the gas generator ball valve seal retainer was torqued at a lower level than normal for the tests which indicated excessive oscillations. A test on the engine which showed abnormal GG oscillations will be repeated this week at the reduced torque condition on the GG ball valve in an attempt to duplicate the results.

Helium accumulator testing and turbopump testing are continuing.

*A. J. Burke*  
for William D. Brown

1 Enc:  
von Braun Notes  
dated 5-13-68

Enclosure 4 I-E-F-68-217





NOTES 5-13-68 BROWN

*Placed request  
to Bureau of  
61468. p.c.*  
B 5/14

F-1 ENGINE The helium injection tests in support of the POGO effort started last week at EFL. The first two of the initial six tests have revealed nothing to cause concern in either engine stability or performance.

*B.B.  
I understand we  
had one incidence  
of a G.F. instability*

A meeting was held on May 10, 1968, to review the turbopump primary fuel seal leakage on vehicle AS-503, engine F-4023. (Reference my notes of May 6, 1968.) Representatives of MSFC (IO and R&DO), KSC, MAF, Boeing, and Rocketdyne, were in attendance. After evaluating all aspects of the problem, it was agreed that the engine should be replaced with a spare engine presently located at MAF. Final disposition is subject to Level II CCB action. This engine change can be accomplished without impact to the current AS-503 launch schedule. After removal, engine F-4023 will be recycled to Rocketdyne, Canoga Park, for corrective action, failure analysis, and returned to MAF as a flight spare. ✓

*(pressure spike)  
conclusively  
caused by  
helium  
injection.  
Please give  
details in  
next NOTES*

J-2 ENGINE Reference is made to the preliminary information given you last week at the MCM concerning the ASI fuel line failure simulation testing at Rocketdyne in which the ASI/dome area sustained damage. Detailed evaluation of the test data and hardware is continuing and we plan a complete updating at the DCR tomorrow. ✓

*B*

Rocketdyne made an interface control drawing inspection of the J-2 engine installed on AS-205, Sunday May 12, 1968. No significant discrepancies were uncovered. A similar inspection will be conducted on S-II-503 at MTO on May 13, 1968. The design of the ASI propellant lines has been finalized. Solid lines will be utilized for both the LOX and fuel lines. The delivery schedule of kits will support the stage requirements. ✓

2331

GEORGE C. MARSHALL SPACE FLIGHT CENTER  
HUNTSVILLE, ALABAMA

*Memorandum*

TO Dr. von Braun, DIR ✓ *B4/29* DATE June 20, 1968

FROM Manager, Engine Program Office, I-E-MGR

SUBJECT von Braun Notes 5-13-68 *14*

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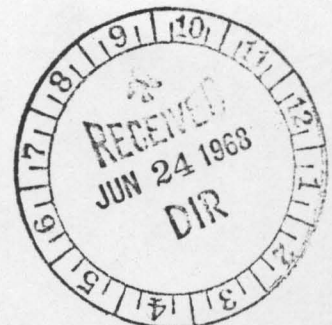
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Helium accumulator testing and turbopump testing are continuing.

*A. J. Burke*  
for William D. Brown

1 Enc:  
von Braun Notes  
dated 5-13-68

*F-1  
20 June  
info available*





B 5/14

NOTES 5/13/68 BALCH

S-II-3 - LH<sub>2</sub> tank entry and Propellant Utilization probe rework have been completed. Stage was installed in the A-2 Test Stand on 5/11/68, one day ahead of schedule. Proof-pressure test is still scheduled for 6/6/68, and shipment to KSC is still scheduled for 6/26/68. ✓

S-II-4 - Stage was shipped on 5/10/68 to Michoud for transshipment to KSC on 5/11/68. ✓

S-II-5 - Modification work is continuing, and static firing is still scheduled for 7/10/68. ✓

S-IC-6 - Stage contractor's preliminary schedule for remaining test program milestones calls for "power-up" on 7/5/68, propellant loading on 7/16/68 static firing on 7/30/68, and removal from test stand on 8/14/68. These dates are tentative pending commitment on delivery dates for modification engineering and hardware. ✓

Public Affairs - I spoke at a luncheon preceding groundbreaking ceremonies for the Hancock County Airport on 5/11/68. Mississippi Lieutenant Governor Charles Sullivan and other state and local dignitaries participated in the ceremonies. ✓

*A very nice & constructive man!*  
B ✓  
Mr. Richard Lewis, a well-known aerospace writer of the Chicago Sun Times, will visit MTF on 5/27/68. ✓

Dr. S. Suito, Japanese novelist and writer, will visit MTF on 5/29/68 to gather material for a 25-article series he is doing on "Life in the United States." ✓



NONMETALLIC MATERIALS CONTROL: We have taken exception to a proposed Headquarters directive which would effectively place control of nonmetallic materials in the hands of a board chaired by the three Center Program Managers, but having four MSC members with only two each for MSFC and KSC. The approach is basically unsatisfactorily, or course, regardless of the distribution of votes.

CLUSTER ATTITUDE CONTROL AD HOC WORKING GROUP: On May 10, we reviewed the Workshop Attitude Control System (WACS) Control and Display requirements with MSC Flight Crew Operations Directorate. Flight crew presented a set of idealized requirements. MSFC, in turn, requested IBM to impact these requirements on the basic automated WACS system. These impacts were discussed with MSC and we agreed that (a) it is required to provide the crew with capability to perform manual mode selection and individual component selection, that is, gyros, amplifiers, thrusters, etc., and (b) it is then not a great step to provide capability for crew control and this will probably be recommended. We hope to have a final joint MSFC/MSFC review on May 22, 1968.

ATM CONTROL AND DISPLAY PRE PDR: The ATM Control and Display pre Preliminary Design Review (PDR) is scheduled for May 16. A mockup of the Control and Display panel in a LM-A tunnel area will be on display in the lobby of 4200 for a week starting May 13, in conjunction with this review.

LM-A PRELIMINARY REQUIREMENTS REVIEW: Working Group and pre Board meetings for the PRR of Lunar Module Ascent Stage modifications to accommodate the ATM mission were held last week. The PRR Board meets May 14. Items referred to the Board are mainly related to definition of primary mission and degree of dependency of the LM-A on the AAP cluster. Studies of alternate configurations to accomplish the mission either have been completed by Grumman or are underway.

ATM FOLLOW-ON STUDY: The ATM follow-on work statement prepared by MSFC was discussed with Mr. Mitchell and Drs. Roman, Glaser, and Smith (OSSA). Dr. Smith indicated he will incorporate a summary of contents of the MSFC work statement into a letter to Dr. Goldberg, in answer to Dr. Goldberg's letter which identified astronomy program requirements for the 1973-75 time period.

It appeared that OSSA depends heavily on MSFC to put engineering realism into their future astronomy program planning. There seemed to be considerable concern about contributions that man can render to an astronomy mission. Dr. Glaser indicated that a desired initial output of this study should be an assessment of the relative effectiveness of unmanned and manned astronomy missions. OSSA favors the detached modes of operations because of apprehensions to MSF program slippages and possible priority of other programs. However, it appears that OSSA (Mr. Mitchell in particular) has a lot of confidence in MSFC's contributions to the astronomy planning.

NOTES 5-13-68 BROWN

B 5/14  
Planned request  
to Brown's office  
6/14/68. pls

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(or pressure spike)  
conceivably  
caused by  
helium  
injection.  
Please give  
details in  
next NOTES

J-2 ENGINE Reference is made to the preliminary information given you last week at the MCM concerning the ASI fuel line failure simulation testing at Rocketdyne in which the ASI/dome area sustained damage. Detailed evaluation of the test data and hardware is continuing and we plan a complete updating at the DCR tomorrow. ✓

B

Rocketdyne made an interface control drawing inspection of the J-2 engine installed on AS-205, Sunday May 12, 1968. No significant discrepancies were uncovered. A similar inspection will be conducted on S-II-503 at MTO on May 13, 1968. The design of the ASI propellant lines has been finalized. Solid lines will be utilized for both the LOX and fuel lines. The delivery schedule of kits will support the stage requirements. ✓



NOTES 5/13/68 CONSTAN

MAINTENANCE, REPAIR AND OPERATION OF FACILITIES COSTS

B 5/14

The Maintenance, Repair and Operation of Facilities (MROF) Cost Report indicates a downward trend in costs in all major categories for the third quarter of FY 68. MROF costs were \$1,942,000 for the second quarter FY 68, \$1,701,000 for the third quarter, FY 68, a decline of \$241,000 during the third quarter. Significant areas contributing to the decline in MROF cost were:

Area	FY 68 <u>2nd Qtr.</u>	FY 68 <u>3rd Qtr.</u>	Amt. of <u>Decline</u>
Management and Engineering	\$123,000	\$ 96,000	\$27,000
Maintenance and Repair	868,000	798,000	90,000
Minor Alteration and Construction	204,000	109,000	95,000

Total MROF costs for the first three quarters of FY 68 were \$5,592,000 and for the first three quarters of FY 67 were \$6,335,000; a decline of \$743,000 during FY 68. ✓



NOTES - 5/13/68 - EVANS

B 5/14

Nothing of significance to report - Safety

NOTES 5/13/68 FELLOWS

B 5/14

Operational Readiness Inspection (ORI): The Operational Readiness Inspection (ORI) Committee met last week to review neutral buoyancy simulation tests. These tests, scheduled to be conducted this week, are needed to verify the procedures to be used in the Large Neutral Buoyancy Simulator. Arrangements were made for medical and safety office representatives to be present for on-the-spot observation of test operations. ✓

1. AS-502 Flight Evaluation: We are presently using Flight Evaluation Panel (FEP) to support MSC investigations into SLA anomaly at 133.3 seconds. Mr. Nathan, R-AERO-F, MSFC FEP Co-Chairman, stayed at MSC until May 8, when he became ill and returned here. Mr. Lindberg, Mr. Nathan's supervisor and Chairman of the Flight Evaluation Working Group, replaced Mr. Nathan at MSC. There are also representatives from P&VE, IBM and Douglas at MSC. ✓

2. J-2S for Cluster I: Re: your question on item 1, Notes 4/22/68, copy attached. Our proposal is to make use of a flight-worthy version of an R&D J-2 "improved" engine, which has been modified to give the operational function and performance gain required for AAP-2 or AAP-4. ✓

3. Impact of S-II Stage Propellant Utilization System Elimination: A study is under way to assess payload effect on Saturn V mission if PU system were removed from S-II stage. Overall payload impact resulting from PU system removal is, of course, dependent upon thrust profile chosen and increase of residuals due to loading and inflight mixture ratio errors. Payload contributions from thrust profile tailoring, either from use of constant  $MR=5.5$  through flight, or by use of timer to step to  $MR=4.5$  during flight, are known. However, increased residuals resulting from loading imbalance and inflight dispersions are of same magnitude (or greater) and their effects are in process of being determined. Final overall payload impact will be reported to you as soon as it is completely verified. A similar study on payload effects of removal of PU system in Saturn I S-IVB stage, is under way. ✓

4. S-IC Flame Backwash Enveloping Rear of Saturn Vehicles at High Altitudes: Jet-induced flow separation is observed on flight photographs of Saturn V at altitudes above 30 km. Flow separation and ensuing recirculation permits blanket of exhaust products to sheath rear of vehicle, gradually progressing to rear of S-II as altitude increases. Between 30 and 40 km this blanket is sufficiently hot to be luminescent; above 40 km it turns into a smoke cone, which by S-IC cutoff has smudged whole rear half of vehicle with soot deposits. No drastic effects on structural temperatures occur. During the luminescent phase (30-40 km), flame sheath temperature is estimated on the basis of color to be around  $1200^{\circ}\text{K}$ , i.e., of same order as free stream recovery temperature; at higher altitudes the sheath temperature must be below that recovery temperature. In short, the phenomenon is spectacular, but not serious. ✓ Flow separation and flame backwash of this kind has existed on virtually every rocket launched to high altitudes. We have observed it on all Saturn flights. It is more easily observable on Saturns due to their sooty kerosene jets, their large size, and their more thorough photographic coverage. By absence of one or several of these factors, it has presumably escaped notice on most previous rockets. A similar, unobserved phenomenon of separation and exhaust backwash is bound to exist during S-II flight, with separation progressing up to and beyond the tip of the CM. S-IVB operates solely in free molecule flow, where this concept of low separation becomes meaningless. However, molecules originating in the J-2 combustion chamber can certainly be picked up all around the vehicle. Some concern has been voiced that oxygen, vented or leaked into this flame sheath, may cause local combustion and heating. We believe that prevailing chemical reaction rates, slowed to a snail's pace by low pressure and temperature, will block any appreciable heat release. Some idealized computer studies are under discussion to back up this opinion. Programs and reaction rate data are available as by-product of our work on jet afterburning and jet radiation. ✓

E.F. Very interesting  
B

B5/14

O.K.

B



B 5/14

J-2 ENGINE: The lines on the J-2 engine have been qualified in the past by J-2 engine qualification testing. There was no component qualification testing accomplished on flex lines. P&VE has proposed to Engine Office a component qualification test program for some of the more critical lines which we have always strongly supported. This test program would subject the lines to an environment which would essentially establish safety factors. If this proposal is accepted, we would be consistent with what is done on every stage—we fear disapproval due to funding shortages. The F-1 engine critical lines should be reviewed immediately for adequacy of qualification testing levels.

Bill Brown  
What's your  
position  
in view of the  
ASI line  
problem in  
502?  
B

We are working together with Rocketdyne on the following:

1. Shake-down inspection procedure for J-2 engines on AS-205, 503, and subs. Status: To be completed by May 13. X-ray inspection of flex lines during our in-house teardown inspection of a production J-2 engine revealed some discrepancies which may require in-place X-ray or removal of critical flex lines on all J-2 engines. Rocketdyne is conducting X-ray evaluation of all available flex lines and is investigating feasibility of X-raying critical flex sections on engines in the field. Flex line bellows will be X-rayed in the future as part of the receiving acceptance inspection. As a matter of interest, X-ray is not a panacea. They are almost useless in evaluating the sleeve welds that Rocketdyne uses extensively or the end caps brazed over the ends of the flex sections. We must depend in these cases, on strong process control and proof pressure testing.

2. Review all of work done from time engines have been shipped in order to determine the adequacy of the work, the inspections, and the retesting for AS-205, 503, and subs. Status: To be completed by May 16 for AS-205 and May 18 for AS-503.

3. Analysis of all manufacturing and operational variables and differences for each ASI lox and fuel line built to date. This to include differences in welding, forming, cleaning, materials, inspections, and tests, for work done by each of the three vendors, in-house at Rocketdyne, and in the field. The purpose, of course, is to discover any differences between the successful and the failed lines. Status: To be completed by May 16 for AS-205 and 503.

4. Review of traceability requirements and procedures and their implementation by Rocketdyne. Status: We presently feel there is a problem in specifying what items are to be traceable. The lower fuel ASI line was not originally specified as a critical item—therefore, there was no requirement for traceability and it is difficult to determine which vendor's line was installed on the engine of AS-502 and to correlate an X-ray to the failed lines. Approximately mid 1966 Rocketdyne took action as a result of a survey to improve their traceability system; however, it was not retroactive. Action is now being taken to assure that every flight critical item will be fully traceable—unfortunately this cannot be totally retroactive due to hardware completion. It has been determined that vendor data for items procured by Rocketdyne is only required to be retained by the vendor for three years from date of final payment to the vendor; therefore, some vendor data for ASI lines has already been destroyed. Immediate action to increase the data retention time to adequately cover vehicle launches is being taken. Complete review to be completed by May 16. ✓



B 5/14

1. LM-A Preliminary Requirements Review (PRR). Last week, MSC held the LM-A PRR at Grumman. Approximately 40 MSFC personnel participated in this review. A total of 176 Review Item Discrepancies (RID'S) were written, of which 35 were submitted by MSFC personnel. Fourteen of the RID'S were referred to the LM-A PRR Board which will meet at Grumman this week. The areas in which there was considerable discussion were as follows:

a. EVA - Should all EVA's for all modes be from the LM-A or from the airlock for the clustered mode which is the present baseline for EVA.

b. Single Point Failures - Certain elements of rendezvous and docking and LM support systems for ATM contain single points of failure. Further review is necessary to determine what can be done to eliminate these failures.

c. Contamination - All areas for potential contamination sources (expelled gases/debris and material sublimation) must be defined by Grumman. MSFC will have to pass judgment on whether these levels of contamination are acceptable.

d. Contingency Mode - The capability for an in-orbit determination of a CSM docked mode (requires probe to be in MDA) has support from both Centers.

None of the above or any of the other RID'S seemed to present a very difficult or insurmountable problem. The combined efforts of MSC, Grumman and MSFC will be able to resolve the problem areas brought out in the PRR. ✓

2. ATM Controls and Display Console. The C&D Ad Hoc Working Group will meet this week at MSFC to review the C&D layout based on the requirements established between MSFC and MSC. This review will effectively serve as a Preliminary Design Review (PDR) and allow the design and hardware fabrication to proceed without major impacts at the time of the ATM PDR which is now scheduled for July 1968. ✓

35/14

ACCESS ARM (ARM 9) During preliminary checkout of Environmental Chamber (EC) of the Access Arm (No. 9) a platform that moves in and out with vehicle motion stuck and could not be moved. KSC contractor disassembled EC on Sunday. Problem is under investigation and KSC is aware of problem. Will impact test schedule but how much cannot be determined until rework effort is defined. ✓

J-2 ASI TESTING The J-2 thrust chamber was fired twice last Tuesday with Augmented Spark Ignition (ASI). The first test was aborted at 5.3 seconds after a hydrogen fire was discovered near the ASI fuel valves. After this problem was corrected, the thrust chamber was fired for 28 seconds. Upon reaching steady state mainstage, the ASI O/F was changed from 0.98:1 to 9.10:1. The resulting ASI throat burnout also penetrated the main fuel passages and the complete center circle of lox ports. Also, two tubes in the thrust chamber wall near the exit were punctured by debris from the burning injector. PAVE is still reviewing the results, but it appears that no additional tests will be required. ✓

F-1 TURBOPUMP The F-1 Turbopump Facility is being prepared for a series of tests on the F-1 POGO problem encountered S-1C powered flight on AS-502. Facility modifications have been completed and the first checkout tests were successfully completed on May 10. POGO testing should begin on or about May 14, 1968. ✓

S-11 STRUCTURAL TEST PROGRAM The S-11 stage was received at the test tower on May 8, and installed in position on May 10, 1968. ✓

S-1B (MSFC) Stage S-1B-12 was installed in the Static Test Tower East on May 6. ✓

F-1 ENGINE Test FW-080 was conducted on the West Area F-1 Test Stand on engine S/N F-5038-1 on May 10. This was the first of a series of tests to evaluate the helium injection POGO fix. Data is under evaluation. Next test Tuesday, May 14, 1968. ✓

S-IVB (MSFC) Test S-IVB-059 (J-2 engine J-2050) was conducted on May 8, for a planned duration of 75 seconds. The stage and engine operated and performed satisfactorily with two exceptions: (1) The engine propellant utilization valve failed to respond to the full closed position when given the command (test switch) approximately 30 minutes prior to ignition and is still under investigation. (2) The fuel pre valve failed to reach the open position within the required four seconds; therefore, the first attempt of test S-IVB-059 was aborted. The suspected problem here is pre valve microswitches. The lox and fuel pre valves will be removed from the stage and inspected to ascertain the problem area. Potentiometers will be installed on both valves in addition to the microswitches to ascertain whether the valves are actually opening or whether the problem is microswitches. ✓

J-2S ENGINE DAMAGE On May 3, while making an electro-mechanical checkout (no load) of the overhead crane in the Engine Support Shop, the Industrial Crane and Equipment Company, a contractor for Technical Services Office, accidentally exceeded the upper limit switch on the crane block and sheared off both side plates which fell on the J-2S engine below. Damage included the helium bottle and the fuel pump inlet duct for sure and possibly the fuel pump which will have to be disassembled and inspected. Cause is being investigated by a special board chaired by Mr. Drinnon of R-QUAL. ✓

K.T.  
I'd like to  
see the  
final  
accident  
report  
B



AS-502 LAUNCH: Various problems were experienced by the Data Reduction Branch in processing all the data required to evaluate the anomalies which occurred on AS-502 launch. These problems were as follows:

a. Failure to follow through with coordination of total data requirements as specified in the Flight Evaluation Working Group contingency plan for failure investigation. The Data Reduction Branch - Flight Evaluation Working Group schedule as depicted in the Processed Data Requirements Document is based on a success schedule. Contingency plans need to be enforced more rigorously for future flights.

b. Failure of Slidell to deliver error-free FM/FM data from S-IC stage. The problem occurred with an analog tape from TEL IV, Eastern Test Range, which had a very strong two cycle/second WOW. Slidell had problems with tape speed compensation and after two unsuccessful attempts to reduce the data, Data Reduction Branch, employing tape speed compensation, reduced the data locally. The erroneous data at two cycles/second had a very pronounced effect on the real five cycle/second data. Slidell will correct their problems.

c. Failure of North American Rockwell (NAR) to provide reduced data from the S-II stage in a timely fashion. After notification of from 48 to 72 hours delay, Data Reduction Branch produced all the data locally, making many expanded oscillograms and highly expanded digital plots around the anomaly areas. NAR claimed time decoder problems and computer problems. These problems need to be resolved.

d. Failure of a concerted effort to provide coordinated data requests to Data Reduction Branch for oscillogram data of the "133 second" phenomena. Data Reduction Branch has supplied local contractors and laboratories several thousands of feet of expanded oscillograms over this time period. In addition, MSC has requested many records of IU and SIVB data as well as data from their own instrumentation. For instance, Data Reduction Branch made oscillograms from the MSC Constant Band Width system as well as from FM/FM data.

This extraordinary effort, not completely finished yet, has required many hours of civil service and contractor compensatory time and overtime. The contractor overtime for this fiscal year is almost exhausted. The experience also points out the continued need for a strong MSFC data reduction capability.

Taped Speech

What are we doing about this?

B

B 5/14

J-2S Stage Impact Studies - R-P&VE held a joint orientation conference kick-off for Boeing, North American, McDonald-Douglas and IBM on the stage impact studies for implementing the J-2S engine with Saturn V Vehicle 518 effectivity. Rather than four impact studies, the job is taking on the character of a single integration study with Boeing coordinating the overall effort to see that the pieces all fit together properly. ✓ Emphasis is being placed on making use of all applicable previous study information so the limited funding is not dissipated in re-doing all of the effort from scratch. I feel P&VE did their home work very well in organizing and coordinating for this kick-off orientation of the contractors. ✓ P&VE has set up a technical panel lead lab type structure to direct this effort. ✓

OART FY 70 Planning Cycle - Ref. item three of my notes of 4/29, copy attached (DIR and R-DIR only). By TWX received May 9, we were advised that the Advanced Research and Technology Board meeting has been postponed from early June to early July. Change in date will provide: (1) a better view of funding to be expected in FY 69, and (2) needed time for Centers to evaluate overall OART plans and respond per guidelines furnished by OART. Guidelines expected week of April 29 are now expected May 15. ✓

Space Power Systems, SRT - A meeting was held on June 8 among personnel of ASO, ASTR, SSL and EO to review the current Research and Supporting Development work on Space Power Systems. It was agreed that an effort would be made to increase the work currently underway in the SRT/SD programs involving nuclear power systems. The program will be laid out to initiate systems type investigations leading to the early application (FY 75 era) of Zr-H (SNAP-8 type) reactor-thermo-electric systems and to lay the basis for use of thermionic systems as they develop. Additionally, increased activity in power conditioning, regulating and distributing subsystems to increase efficiency, reduce weight and improve lifetime and reliability is being planned. This program is planned to constitute an appreciable portion of the OMSF AAP Supporting Development Program for the next three to five years. ✓



NOTES 5-13-68 KUERS

B  
5/14

1. S-II Mini-Stage: Last week we delivered this stage to Test Laboratory as scheduled. The common bulkhead repairs were accomplished prior to delivery. The spray foam insulation was not fully completed. Approximately 200 hours of work for installation of the Mylar covers over purged areas and completion of close-outs for strain gage wire leads will be performed by ME personnel while the stage is being installed on the test stand. The travel of this workload was agreed upon with Test Laboratory prior to delivery. ✓
2. ATM Solar Panels: The manufacture of these panels is now ten days behind schedule because all personnel in the bonding shop have been working in three shifts on the foam insulation of the S-II Mini-Stage. Work has now been resumed on the panels and some of the lost time will be recovered. ✓
3. Boiler Plate "30" Dummy Payload: This payload was returned from KSC for modifications and beef-up as a backup for SA-503. Plans are now made to build four new ballast tanks for this payload. ✓



1. CHANGE OF ALLOY FOR S-II: Reference Lucas Notes 4-1-68 concerning the new S-II material, the \$15M original cost estimate by North American Rockwell (NAR) for the change has been revised to approximately \$9M. This covers the cost of purchasing replacement material, machining, forming, and welding on a prime time basis (2 shifts - 8 hours) to get the production back to the same point it was when the material changeout was initiated. Material cost alone approximates \$2M of the total. NAR is subcontracting to The Boeing Company/Wichita and Rocketdyne in addition to using their own LA Division facilities, all on prime time and these activities account for the approximately \$7M above the materials cost. The -063 material is now being retrieved and checked into a bonded warehouse by R-QUAL. When all the material is accounted for, NAR will certify this by letter. ✓
2. SATURN I WORKSHOP FLAMMABILITY: Reference is made to your comments on P&VE notes 4-22-68. We have transmitted our concerns and objection to the proposed document to Mr. Belew who will take the appropriate action with Chuck Mathews. In addition, to insure common understanding of flammability problems and to furnish a mechanism for their resolution, we are proposing that the AAP Systems Safety Panel include a subpanel on flammability. ✓
3. SATURN IB WORKSHOP COATINGS: By pigmenting an inorganic coating developed by our Materials Division with metallic oxides, we have been able to duplicate the colors proposed by Mr. Loewy for the workshop interior. We learned that 3M has stopped manufacturing the synthetic mica which is the basic ingredient in the coating, but that we can buy the entire stock of 4000 pounds (ten 55-gallon drums) for less than \$500.00. The coating is nonflammable, tenacious, resistant to mechanical and thermal shock, and will provide the emissivity values required for the thermal control. Scale-up of production of the coating to large quantities is not expected to be a problem. ✓
4. STAGE IMPROVEMENT STUDIES WITH RESPECT TO J-2S ENGINE: A kick-off meeting for the Stage Improvement Studies was held in P&VE May 7-8, 1968, to determine the requirements and impact of incorporating the J-2S engine in the stages. Contracts for 11 months have been let with McDonnell Douglas, North American Space Division, International Business Machines, and The Boeing Company. Each of the contractors has acknowledged the importance of the studies by virtue of the competent personnel assigned to the investigations. ✓
5. AAP MECHANICAL PANEL WORKING SESSION: The AAP Mechanical Panel held a special working session 5-2-68 at MSC. Thirty open action items were reviewed by the cochairmen and cosecretaries. Twenty-five action items were closed. With the transfer of the AM and LM-A to MSFC, center interface problems between flight systems will be drastically reduced. Emphasis will be shifted to the Experiment interfaces and an Experiments Integration Sub-Panel appears necessary for the AAP Mechanical Panel. ✓
6. ENCAPSULANTS PATENT: Mr. Jerry Patterson of our Materials Division conceived a series of epoxy silane encapsulant compounds for electrical components. The idea was incorporated in a scope of work and the resultant contract has produced encapsulants which are far superior to commercially available products. Mr. Patterson will be listed as co-inventor in a patent application being filed by the contractor, Monsanto Chemical Company. ✓

TECHNICAL BASELINE STUDY - As an outgrowth of the meeting at Marshall on May 2, 1968 with Mr. Donlan and the Technical Deputies of the MSF Center we have developed a rationale for a level of technical activity which we feel is compatible with the companion effort of Gen. Bogart's committee on the institutional baseline study. Alternatives for post-Apollo activities appear rather limited. Either we can continue to plan for the 5 flight AAP "Core" program or we can consider other approaches that might be open to us.

The primary option we have considered (Option A) is to continue to pursue the basic intent of the "Core" program even under the severe limitation of the institutional baseline study. Other approaches (Options B-1, B-2, & B-3) force us to give up the cluster concept and fly the "Core" missions on an as available basis as shown below:

B-1 : Saturn I Workshop (no ATM), followed by Saturn V Workshop .

B-2 : ATM (no Saturn I Workshop), followed by Saturn V Workshop.

B-3 : Both Saturn I Workshop and ATM (in series one following the other) followed by Saturn V Workshop.

These options, including a first cut set of assumptions, guidelines, and utilization of Civil Service manpower and dollar resources were datafaxed to Mr. Donlan on May 13. Endorsement of Option A was recommended. ✓

LM/ATM Discussions with OSSA: Dr. Mueller called a meeting of the LM-ATM Evaluation Board to discuss the concern of Dr. John Naugle and his people about the present ATM plans.

Dr. Naugle started the discussion by reminding everyone that the ATM represents NASA's next major step in Solar Astronomy and there is no other program to back it up. He then listed his concerns about the program. These were:

(a) The long series of mission events which must happen before ATM data gathering can be started.

(b) No backup for the LM. (They understand the ATM prototype is flyable.)

(c) The continued slip in the program which could lead to ATM activity in 1972 instead of 1971, which in turn might make some of the experiments questionable.

(d) EVA requirements have apparently been questioned by the crew. He was concerned about astronaut safety in the present EVA plans.

To this last point, Mr. Robert Thompson stated that the only concern had been to thoroughly justify the need for EVA. He said this has now been done, and the EVA problem will be worked and handled properly to support the mission.

Dr. Mueller, Mr. Mathews, Mr. Luskin and others then gave their viewpoints. Dr. Mueller finally summarized and stated that, barring procurement and funding problems, he felt the program would meet OSSA requirements in 1971. He asked Dr. Naugle's support in obtaining a backup modified LM. (Estimated cost \$20 million) Also, he said we would further refine our studies of the uncoupled LM-ATM mode. With these actions, John Naugle said he would remove his objections and support our program. ✓✓



B 57/14

1. POGO:

A review of the POGO activities was held with Mr. George Hage (MSF) on Thurs., 9 May 68. You will be briefed further on these activities this afternoon. ✓

2. S-IC-3 Stage at KSC:

S-IC-3 outboard control F-1 engine (position #1) has a fuel seal leakage in excess of 10 times spec value as measured by nitrogen leak test. A tentative position was established on Fri., 10 May 68, to replace this engine at KSC (see Notes 5-13-68 Brown). The final position is expected to be formalized on Mon., 13 May 68. Coordination has already been established with KSC and with Gen. Phillips. ✓

3. S-II-3 Stage at MTF:

- o Stage was placed on the test stand on Sat., 11 May 68.
- o Cryogenic proof testing is scheduled for Thurs., 6 June 68.

4. S-II-4 Stage:

S-II-4 Stage left MTF by barge on Fri., 10 May 68. Due on dock at KSC on Wed., 15 May 68 (two weeks ahead of schedule). ✓

5. Boiler Plate-30 Spacecraft at MSFC:

Weld cracks in the service module ballast tanks will be quite difficult to repair. Best solution appears to be fabrication of new tanks by R&DO. The R&DO plan for refurbishing the service module to a flight ready condition is to be completed by Fri., 17 May 68. ✓

1. READINESS OF OPERATIONAL SUPPORT SYSTEMS: General Stevenson formally reviewed the status of MSFC and KSC operational support systems and their readiness for manned flight. The meeting was held on May 9 at KSC and addressed the HOSC, Central Instrumentation Facility, AF Eastern Test Range Support Systems, Communications, and KSC measuring and instrumentation systems. All systems appeared to be in good shape and ready for manned flight. Our HOSC presentation was well received. ✓

2. ACCESS CONTROL TO OPERATIONAL COMMUNICATIONS: General Stevenson chaired a meeting on May 10 at KSC to review the control of access to operational voice loops, and assess the workload and operational impact due to turning down communications circuits between missions in order to effect cost savings. Since the 204 accident, considerable emphasis has been placed by OMSF on the control of access to operational voice loops and we are working with MSC and KSC to insure strict control. We expect no serious effect on HOSC operations since rigid facility control is observed. We are also continuing our efforts jointly with Management Services to investigate the feasibility to drop circuits between missions to effect further savings in LIEF communications. ✓

NOTES 5-13-68 Stuhlinger

B 5/12

No submission this week.



SA-205 DELTA DCR: The Delta DCR for the SA-205 launch vehicle is scheduled to start tomorrow morning at 8:30 in the LIEF Conference Room, Building 4663. Although the majority of the presentations are to be given by stage and GSE contractor personnel, I feel sure that we will get full support of the key R&DO laboratory personnel in making this a complete and informative review for the DCR Board. ✓

SA-205 STATUS: S-IVB forward skirt and the IU were restacked on 5/9/68 and 5/11/68 respectively. The installation operation of the S-IVB forward skirt was accomplished without any technical problems, however, before the skirt could be bolted to the LH<sub>2</sub> tank flange, it rained. The skirt was covered but water ran down the outside and into the mating surface and bolt holes. A decision was made to raise the skirt and dry the surface before bolting the skirt in place and this was accomplished on 5/10/68. A total of 140 huck bolts were replaced in the forward skirt. All bolts showing any discoloration were replaced. Only 3 or 4 of these had any significant indication of corrosion. ✓

On IU-205 all required cable and connector replacement and cleaning of the surfaces and subsequent verification have been accomplished. IU-205 is ready to support the checkout operations. ✓

SA-205 VALIDATION EVALUATION: The effort headed by Charlie Brooks of R-QUAL to assure that all modification made to the launch vehicle after manufacturing checkout received an adequate retest/inspection is progressing satisfactorily. Major portion of this task will be completed by mid-June. ✓

MISSING FLOW TUBE FROM S-IB-9: You may recall several months ago a flow tube was lost out of the fill and drain valve (Parker Valve) on S-IB-9. It was suspected that the tube was lost during static test operations. S-IB-9 and S-IB-10 (tube could have entered this stage during static test operations) were searched to assure that the tube was not in the stages. During the two past weeks we had an opportunity to search the 24 inch drain line and the 3 fuel storage tanks at static test. The flow tube was found in the center fuel storage tank and has been sent to the Materials Laboratory at Chrysler-Michoud for metallurgical evaluation to determine if it was made of the proper alloy and if it had been heat treated to the proper temper. ✓



B 5/14

1. Saturn V Workshop: Jim Madewell attended a meeting at NASA Hqtrs. on 5/7 in response to the Mathews letter requesting further study in this area. This effort is being directed by Dr. Dixon in Doug Lord's shop for Chuck Mathews. The meeting was attended by Langley (MORL office has action) and MSC (Action: Bob Thompson, but work conducted by Ralph Hodge, Bill Stoney's shop). Response is expected at Hqtrs. 1 July; it will be input to a program memorandum to go to BOB July 31. Subsequently, further in-house studies will refine concepts, and a phase B/C competing contract study might be put out to industry around January 1. Mathews asked for independent recommendations from the three centers involved and has included specific guidelines and objectives. The most significant attitudes reflected in guidelines and discussions are: (1) decoupling major experiments design, schedules, and funding from space station development; (2) modular configurations which can be used in polar orbit or synchronous orbit including potential use by DOD and on DOD launch vehicles; (3) do not use existing structure (S-IVB) unless proven to be more effective. It was repeatedly stressed that the design input was programmatic alternatives rather than configuration design. Langley will support this effort with 15-20 people; MSC will assign 5 or so people. We plan 4-8 people in ASO. Our principal output will be programmatic and will draw from a previously planned 8-month in-house study analysis of the modular approach.

2. Chrysler "National Space Booster Study": On 4/30/68, Dan Schnyer (MSF Manager of the Chrysler study contract) met the "Study Team" at MSFC, including representatives from MSFC (IO and R&DO), KSC, MSC, OSSA, OART, and MSF. Study Team participation was discussed, and an orientation meeting with Chrysler was planned. We were later informed by Mr. Schnyer that plans have been changed, based on a 5/3/68 meeting of Messrs. Webb, Mathews, Schnyer, and Lowery (CCSD).

(a) Chrysler was instructed to devote the first 2-3 months of the 12-month period to the collection of launch vehicle data from Saturn and other vehicle/stage contractors, and the analysis of this information.

(b) The planned orientation meeting with Chrysler is cancelled.

(c) There will be no direct participation by the MSFC Study Team members during this initial 2-3 month period; MSFC participation will be re-evaluated after completion of this first phase.

Contacts with other companies are being made by Mr. Lowery personally, at the company president level. Convair and Boeing have been contacted by Chrysler; schedules for visits to other companies are being arranged. Dr. Rees is to be contacted by Mr. Webb regarding any MSFC and KSC inputs or assistance to Chrysler.

Frank L.

I'd like to have a personal appraisal from you  
on merits and objectives of this Chrysler study.  
No formal briefing, just a chat between the two of us. B

May 20, 1968



WHITE  
25% COTTON  
AC/ENCE



NOTES  
MR. GORMAN'S COPY

MAY 20 1968

*Without comments*

*Mr. Gorman*

NOTES 5-20-68 HOELZER

RESIGNATION OF KEY EMPLOYEES: Two of the Computation Laboratory's most valuable employees, Charles L. Bradshaw, Deputy Director, and Charles P. Hubbard, Chief, Engineering Computation Division, have submitted their resignations effective May 31, 1968. They are joining a group of five other people in forming a computer service company to be based in Huntsville.

*5/20/68*

*1. a  
w hly  
notes*

Mr. Gorman

NOTES 5-20-68 HOELZER

RESIGNATION OF KEY EMPLOYEES: Two of the Computation Laboratory's most valuable employees, Charles L. Bradshaw, Deputy Director, and Charles P. Hubbard, Chief, Engineering Computation Division, have submitted their resignations effective May 31, 1968. They are joining a group of five other people in forming a computer service company to be based in Huntsville.

Team -  
I sent Gorman  
to Mr. 5-21-68  
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notes



*John*

NOTES 5-20-68 WILLIAMS

1. Extension of Manned Space Flight Capability (EMSFC) Working Group:  
As a result of Chuck Mathews' recent request for independent Center studies and recommendations for earth orbital programs, we have been receiving similar requests from the various subpanels of the EMSFC (Lord's group). We have informed the various subpanel chairmen (Maggin - Goals and Objectives; and Howard - Program Options) that, as a result of our inability to work all requests simultaneously, our emphasis will be on supporting the Mathews request which is being worked by Dr. Dixon. It is also our understanding that the MSF input to the Newell EMSFC panel will be based on the Mathews study.
2. Lunar Working Group - Single Site Sub-Group: The "single-site" sub-group to the Lunar Working Group met at Goddard during May 13-15, 1968. Mr. Dave Paul and Mr. James Belew attended for MSFC. This concept of a lunar program, structured around multiple revisits of a single-site, was suggested by Newell and the PSG as a credible alternative to the multi-site philosophy heretofore considered effective. The sub-group with representation from OMSF, OART, MSC, MSFC, LRD, GSFC and Bellcomm, re-analyzed the principle issues, objectives, goals, and special studies from the standpoint of the single-site concept. Several advantages of this approach were defined (stockpiling, re-use, enhanced scientific "depth" etc.); however, the group has not been asked to contrast the contending schemes. It is felt that they would recommend keeping the current approach rather than changing.

RECEIVED DEP-A

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Notes*

NOTES 5/20/68 BALCH

S-II-3 - "Power-up" was completed on 5/17/68. Cryogenic proof pressure test is tentatively rescheduled from 6/6/68 to 5/30/68. This would permit shipment to KSC on 6/22/68 instead of 6/26/68, as previously scheduled.

S-II-5 - New LOX prevalves have been installed, and installation of LH flight vent valves is in progress. Static firing is still scheduled for 7/10/68.

S-II-6 - Stage is expected to arrive at MTF from Seal Beach on 6/9/68.

S-IC-6 - It is understood that some consideration is being given to performing multiple tests on the S-IC-6 stage as part of POGO investigation. Close contact is being maintained with R-TEST on single-engine investigations. No firm test program milestones have yet been established.

Legal Affairs - Mr. and Mrs. M. O. Pigott of Picayune, Mississippi, have filed suit against the Government in the Federal District Court at Biloxi, Mississippi, for damages "in excess of \$9,000" to their property allegedly caused by the static firing of the S-IC-5 stage at MTF on 8/25/67. Their claim in the amount of \$11,705 for the same alleged damages was denied by MSFC on 11/30/67.

SIGNIFICANT FUTURE ACTIVITIES: Some of the significant activities in the near future include: (1) Ad-Hoc Cluster Attitude Control Working Group report to Mathews; (2) AAP 2-4 Payload Shroud Jettison Scheme Report to Mathews; (3) WACS and Solar Array PRR; (4) LM/ATM Unmanned Rendezvous Report to Mueller/Mathews; (5) Report to Mueller/Mathews on integration of biomed experiments in MDA (Luskin's request); (6) Continuation of analysis of earth-looking experiments in the MDA/AM and a future report on this subject; (7) MDA Crew Stations Review.

MDA BIOMED/EARTH-LOOKING EXPERIMENTS INTEGRATION: MSFC presented the results of a one-month effort aimed at integrating and conducting biomedical experiments in the MDA prior to OWS activation; providing LM/ATM Unmanned Rendezvous and docking vestibility and control station requirements with the MDA; and integrating a package of seven earth-looking experiments into the Airlock/MDA. Headquarters approved integration of biomed experiments in MDA and deferred the earth-looking experiments. See detailed note - Dr. von Braun's copy only.

ATM CONTROLS AND DISPLAYS (C&D) DESIGN REVIEW: An ATM C&D Design Review successfully completed 4 months of effort on May 16, 1968. Specifically, the following was accomplished: (1) Integration of the C&D into the LM-A, including console configuration and envelope agreement. (2) Panel Layout (subject to detailed simulations) agreement. (3) All C&D RID's from the ATM PRR were closed, and the C&D Ad Hoc Working Group dissolved.

We can now establish preliminary ICD's and proceed with detailed C&D design. I feel the C&D Ad Hoc Working Group did an outstanding job in pulling together and consolidating the many inputs and establishing the current baseline.

On May 15, and in conjunction with the above review, astronauts Gibson and Garriott along with Mr. McElmurry of MSC performed integrated ATM experiment and pointing control system simulations with the simulator located in the MSFC Computation Laboratory. The findings from these simulations also indicated the panel layout to be acceptable.

McDONNELL DOUGLAS CORPORATION HOLDING POSITION: Action has been initiated to reduce the monetary limit of the Letter Order Amendment with McDonnell Douglas Corporation from \$12.5M to \$7.5M for the last six months of FY 68. This is in consonance with an average manpower level of 490, and is effective until June 30, 1968. Additionally, procurement of all materials and hardware for flight and training items will be screened by MSFC prior to release. Design, development, development testing, etc., will continue toward a timely Critical Design Review.



## NOTES 5-20-68 BROWN

J-2 ENGINE - Current J-2 engine ASI investigations are as follows:

Tests have led Rocketdyne and MSFC R&DO to conclude that the AS-502, S-IVB, and S-II failures resulted from leaking ASI fuel lines.

Rocketdyne simulated the S-IVB failure on an engine at Santa Susana. An ASI fuel mixture ratio was progressively changed from 1:1 to 10:1 and then line failure and flow reversal were simulated. A sizeable hole was burned through the ASI around the fuel line inlet and the gimbal block attachment flange was eroded. The engine data shows very little change and correlates with the flight results.

MSFC Test Lab simulated the S-II failure on a pressure-fed chamber test. An ASI mixture ratio of 10:1 simulating a fuel leak was utilized and the thrust chamber injector was badly eroded toward the LOX dome. Half the wall separating the hot gas from the LOX dome was eroded in a 30-second test (S-II ran 90 seconds after the ASI fuel leak started). Pieces of the injector pierced the thrust chamber and produced side loads comparable to those seen in flight and gave engine performance shifts which correlate with flight data.

A detailed inspection of the J-2 engine on S-II-503 has been completed at MTF and no significant discrepancies were found. A similar inspection is being planned in the immediate future for the engines on S-IVB 205 and 503 stages.

F-1 ENGINE - The inspection of S-IC-3 F-1 engines for the missing segments of the stage quick disconnect teflon seal has been completed (reference notes 5-6-68). Two additional small pieces (1/8" x 1/8") were found on the floor after the vehicle purge system was turned on prior to the inspection. The inspection revealed that the engine injectors and lines were free of contamination. No additional inspections are planned and the engines are considered acceptable for flight.

POGO - Tests to evaluate effects of helium injection into the LOX suction of the F-1 engine are continuing at EFL. Preliminary evaluation indicates the following effects:

Pump Dynamics - LOX inlet oscillations were reduced about 50%. A lower amplitude was noted on LOX pump inlet accelerometer and there was no change in blade wake frequency.

Gas Generator Dynamics - Gas generator oscillations are amplified by the helium injection. The oscillations can be reduced by reorificing to provide higher total flow rates to the gas generator.

Engine Thrust - Helium injection rate of 2% by volume resulted in about 7K pounds thrust loss.

Main Chamber Dynamics - Helium injection damps the main chamber dynamics.

LEVEE ENLARGEMENT PROJECT, MICHLOUD ASSEMBLY FACILITY

The Corps of Engineers' levee enlargement project around the Michoud Assembly Facility, as part of the hurricane protection plan, is generally divided into three phases.

1. Levee around Michoud slip and dock area.
2. Levee along the Gulf Intracoastal Waterway and sheet-piling bulkhead at storm drainage pumping station.
3. Levee (or sheet-piling bulkhead) along Michoud Canal.

As of May 15, 1968, the status of each of these phases of the Michoud levee enlargement project is as follows:

1. The contract for the levee around the slip is scheduled for award in March 1969.
2. The invitation for bids on the levee along the Gulf Intracoastal Waterway and the sheet-piling bulkhead at the pumping station will be advertised in May 1968. Award should be made in July 1968, and it is anticipated that construction will begin in August 1968.
3. The design memos for the Michoud Canal section are currently being prepared, but no approval date can be projected at this time.

NOTES - 5/20/68 - EVANS

Nothing of special significance to report - Safety



NOTES 5/20/68 FELLOWS

Negative Report.

1. Plume Impingement on AAP Vehicles: Re: your suggestion on item 3, Notes 2/5/68 Geissler (copy attached). On May 2, Mr. Dahm gave an informal presentation to Representatives of U of A Research Institute about low density flow problems encountered on AAP vehicles. Some problems were identified where members of the Institute's Staff could potentially offer contributions. An unsolicited proposal by Dr. Wu on an analytical study of a jet expanding into a vacuum is expected.
2. Concerning High Reynolds Number Test Equipment: It looks as if our struggle for this facility has broken some ice. Both Boeing and AEDC are now studying seriously facilities of their own, and have repeatedly contacted us for discussions and pilot study results. An AEDC group was here all day on 15 May. They think so big that it makes even our original facility proposal look puny. They plan: A 12 ft test section (we proposed 5 ft/have now 32"); 1000 ft charge tube length (300 ft/250 ft); 15 ft charge tube diameter (8 ft/3 1/2 ft); 775 psi charge pressure (650 psi/600 psi); cost estimate (optimistic) \$10 million (\$2.7 million/\$500,000 actual). Their immediate aim is investigation of stability problems of large airplanes in the transonic range ( $0.8 \leq M \leq 1.25$ ), where Reynolds Number effects on shock location seem to cause trouble. Their layout goes far beyond these immediate problems, though, and they strive to build a National High Reynolds Number facility. For example, airplane models cannot stand their full charge pressure; only low aspect ratio wings and rocket models can survive the stresses caused by their full pressure level. We sadly feel that despite our prodding NASA has missed the bus, owing to the NIH (Not Invented Here) syndrome.
3. AS-502 Flight S/C Evaluation: MSFC, through Flight Evaluation Panel, is continuing to support MSC investigation into the 133 second anomaly. Representatives from IBM and MDC are still at MSC. Team has agreed now that there was some form of structural failure above IU at this time. Pressure drop in SLA/IU compartment, measured by a pressure measurement inside S-IVB forward skirt and in sublimator system, is considered to be valid indicating a hole size of between 14 to 49 ft<sup>2</sup> developed at this time. No definite conclusions have been reached yet as to problem failure. There seems to be a strong consensus that POGO oscillation coupled into lateral direction probably was initial cause of their problems. Prime suspect failures seem to be failure of outside facing sheet of honeycomb on SLA, failure of LM attachment fitting to SLA or possible failure in LM itself. Planned dynamic test of S/C stack seems to offer the only possibility now of identifying the failure point. Support from Computation Lab, P&VE, IBM and MDC have been outstanding.
4. Saturn Platform Failure Activities: Possibility of incorporating platform backup scheme has been considered for some time and more recently, incorporation of integrating rate gyro scheme was proposed to both IB and V Program Offices. Primary purpose of this method was to alleviate near pad and high Q abort conditions. Crew Safety Panel went on record recently as supporting need for backup capability to permit flight through Max Q. MSC Crew Safety people discussed this with Low and Kraft on May 10, and Kraft was completely opposed to backup scheme or scheme that might have man-in-the-loop for any flight phase. It now appears that MSC will finally drop this subject although some people at MSC and some of flight crew still feel there is a need in this area. We will now go to MSC and try to develop rationale for aborting for platform failure. It may require some redundant S/C display to be provided or that abort be initiated at a lower Q Ball reading than previously planned for this failure for Saturn V. Saturn IB is fairly safe in Max Q region. Both IB and V vehicles may experience vertical flight from failures occurring from liftoff to time of tilt initiation. At present, for 205 platform failures in  $\approx$  0-10 sec region will result in exceeding range safety boundary conditions. Abort will be initiated at the time the range safety limit is exceeded. At present, there is a difference of opinion at MSC as to whether this constitutes a safe abort. We have furnished data to MSC and they are presently looking into the problem.

1. S-II-4 TURNOVER: The S-II-4 turnover meeting was held at MTF 5-4-68, and the stage has arrived at KSC. MTF transferred 3,135 manhours of work, and Seal Beach deferred 4,165 manhours of work to KSC. MTF transferred work was scheduled to be done at MTF but was not accomplished. Seal Beach deferred work was scheduled to be done at KSC. All work accomplished after post-static checkout was identified and revalidation requirements were transmitted to KSC as contractor non-conformances.
  
2. NDT OF 2014-T6 ALUMINUM GRAIN SIZE: The recent problems encountered with 2014-T6 aluminum of large grain size provoked an investigation of possible nondestructive test methods to measure grain size in this alloy system. The methods were intended for use if traceability and/or etching information proved unacceptable. The investigation revealed at least one, and possibly three methods which can be used. The technique that was definitely established as capable of measuring grain size is X-ray diffraction using the back-reflected method. In this method, an X-ray beam is impinging on the surface of the material, and the diffracted pattern is recorded on Polaroid film. The diffracted pattern is in the form of concentric circles about the path of the incident beam. The degree of continuity of these circles is a function of grain size. Using this method, grain size determination could be made in approximately 15 minutes. This short time is due to ease of equipment set up; the fact that no special surface preparation is required; and that Polaroid film use provides for immediate data analysis and process evaluation. Two other techniques, ultrasonic attenuation and electrical resistivity measurements, have shown promise, but a complete evaluation of these techniques could not be carried out due to the limited size of available samples. Upon receipt of large samples, these two techniques will be explored further.



1. ATM Simulation: Astronauts Gibson and Garriott participated in ATM simulations in Comp Lab on May 15. They performed daylight activities such as positioning the experiment slit on simulated solar flares and exercising the switch operation sequences for numerous experiments. They performed night-time operations such as manual gravity gradient momentum dumping. The following comments were made:

- a. They were favorably impressed with the realism and progress made on the simulation.
- b. They verified that roll about the sun center appeared to be acceptable, and they could not justify the switch to the roll about an offset line-of-sight in view of the extra cost involved.
- c. They indicated satisfaction with the manual gravity gradient desaturation. This method is required only in case the digital computer system fails.
- d. They requested the use of telemetry for sending momentum components back to ground instead of using voice link. This is required if manual gravity gradient desaturation is used.

2. ATM Controls and Displays: Representatives from MSC, NASA Headquarters and the PI's participated in the review of the ATM Controls and Displays Panel as defined by the MSFC/MSFC Ad Hoc Group. As a result of this review, the Controls and Displays Panel has been baselined and detailed design can proceed by MSFC with Bendix/Martin support. The interface control of the Controls and Displays Panel will be handled by the MSC/MSFC Electrical Systems Panel (Messrs. Miglicco and Fichtner).

3. ATM/Harvard College Observatory Telescope: Personnel at Harvard College Observatory have expressed their desire to reinstall their HCO "A" experiment back into the program rather than HCO "C". Their reasoning is that if the schedule continues to slip, i.e. beyond early 1971, and the launching is in the very quiet sun years, the HCO "C" experiment will not be of much value. The impact on the ATM integration and interfaces with this change would not be very severe. The main impact would come from the availability of the HCO "A" experiment which could be significantly beyond early 1971.

F-1 ENGINE Test FW-081 was conducted on the West Area F-1 Test Stand with F-1 Engine S/N 5038-1 on May 15, 1968, for a mainstage duration of 121.3 seconds. This was the second of a series of tests to evaluate the helium injection POGO fix. The lox tank ullage pressure was varied to allow 20 seconds of mainstage operation at lox pump inlet pressures of approximately 90, 110, 130 and 150 p.s.i.a. total. During each 20 seconds steady state period, gaseous helium was injected at the top of the lox suction duct for approximately 10 seconds. The helium flowrate was approximately 0.125 Lbs/Sec. Primary test objective was to evaluate the effects of helium injection on engine performance. Data from this test are being evaluated. A manual reduction of engine performance on previous test FW-080 during the steady state and injection time intervals gave no indication of performance variations during the injection period. Preliminary analysis of the high frequency data of that test, including the gas generator chamber pressure, did not reveal any abnormal oscillations.

MODERATE DEPTH LUNAR DRILL The contractor's response to the RFQ's has been received and comments returned. Best guess would put end of next week for the paperwork to go to the contractors for contract award.

S-11 STRUCTURAL TEST PROGRAM The LN<sub>2</sub> cold shock of the cryogenic system will start May 27, 1968.

S-1B (MSFC) All eight lox pump seals were removed from stage S-1B-12 and new bellows seals were installed.

S-11-3 was installed in the A-2 Test Stand at MTF on May 10, 1968. Special hardware will be installed and the stage will undergo a cryogenic proof pressure test on June 6, 1968.

S-11-4 was shipped from MTF to KSC on May 11, 1968, after completion of the acceptance tests and a cryogenic proof pressure test.

S-11-5 is installed in the A-1 Test Stand at MTF. The cryogenic proof pressure test has been completed and the stage is now in a modification period due to a 30 day schedule stretch-out. The acceptance static firing test is scheduled for July 10, 1968.

ACCESS ARM TESTING (SWING ARM NO. 9) (Reference 5/13/68 NOTES\*) Erratic operation of extension platform was traced to a faulty platform seal and an unsupported extension cylinder which oscillated during extension and retracting. Chamber was disassembled on May 12, and reassembled on May 15. Five test days were lost due to the problem. KSC is aware of problem, necessary re-designs and test schedule impact.

F-1 TURBOPUMP POGO TESTING Two successful POGO tests were conducted at the F-1 Turbopump Facility last week. The first test was at a lox pump inlet pressure of 90 p.s.i.a. and the second at a lox pump inlet pressure of 110 p.s.i.a. As planned, a Whittaker lox pre valve was installed in the system replacing the Air Research pre valve after the first POGO test. Two POGO tests at lox pump inlet pressures of 130 p.s.i.a. and 150 p.s.i.a. are planned this week, which should complete the tests on the Turbopump assembly presently installed in the facility. Installation of the second Turbopump should begin the latter part of this week.

(\*Attached for Dr. von Braun and Mr. Weidner.)

RESIGNATION OF KEY EMPLOYEES: Two of the Computation Laboratory's most valuable employees, Charles L. Bradshaw, Deputy Director, and Charles P. Hubbard, Chief, Engineering Computation Division, have submitted their resignations effective May 31, 1968. They are joining a group of five other people in forming a computer service company to be based in Huntsville.



NOTES 5/20/68 JAMES

Saturn V Program Management Transfer: In the past few weeks, Dr. Rudolph had each of his Stage and Staff Managers brief me on their organization, problems, etc., and this past Thursday he conducted a complete Saturn V Program Review for my benefit. I feel that I have been thoroughly indoctrinated into the Saturn V activities and I am certainly appreciative of the efforts Arthur has made to assure a smooth transition in the management of the program.

S-II Stage LOX Fast Fill at KSC: In order to eliminate the requirement for slow filling the LOX tank on the S-II Stage at KSC, we have been working to resolve the problems with the LOX fast fill system. Actions underway include a revision to the KSC loading procedures which allows the first 15,000 gallons of LOX pumped through the fast fill system to be dumped into the disposal pond. This will assure that the warm LOX and associated high velocity gases have been removed and cold LOX is at the service arm at the time the fast fill is opened into the S-II Stage. KSC has also revised their pumping system in order that the fast fill rate does not exceed 4,500 gpm in lieu of the 5,000 gpm previously used. We are revising the baffles and installing filters inside the S-II Stage LOX sump. The revised fast fill system will be used for the first time during CDDT on AS-503; and we will have the tank inspected after CDDT.

S-II Stage Material Problem: In the process of fabricating the spec-021 material (which replaces the defective -063 material) for S-II-11, NAR damaged 6 quarter panels and 1 bolt ring segment to such an extent they had to be scrapped. Problem has received priority attention from NAR and MSFC/RMO Management. Operations were shut down until all conditions relative to each incident had been analyzed and detailed corrective action outlined and implemented.

Pending Buildup of Work at KSC on AS-503: Due to added instrumentation requirements, POGO fix, ASI lines, single failure point eliminations and lack of qualified parts until later in the summer, a heavy modification workload will be placed on KSC during the hi-bay period. Current indications are that more work is being scheduled for KSC than can be accomplished without delaying the prelaunch activities. We are expediting the hardware and meeting with contractors and KSC to resolve the problem.

NOTES 5/20/68 JOHNSON

Nothing of significance to report.

NOTES 5-20-68 KUERS

1. Depletion of AAP Funds for Procurement of Material: Procurement of raw material, standard hardware, and electrical connectors for the AAP program is at a "standstill" because of depletion of ASG funds for direct material. Approximately \$156,000 worth of procurement actions are being returned to ME Laboratory.
2. Neutral Buoyancy Simulator (75 ft dia): A preliminary draft of Safe Operating Procedures has been completed during this report period. An operational checkout run on all systems except the diving bell/airlock has also been completed. Procedures for underwater suit operation and emergency techniques will be operationally checked during the week of May 20. This will complete the checkout of operating procedures. A presentation on operating procedures, systems, and maintenance was made to the Neutral Buoyancy ORI Committee on May 16. This office will initiate neutral buoyancy testing as soon as the underwater suit check and emergency procedure check are complete and approval received from the ORI Committee. This is expected during the week of May 20.
3. Retrenchment Study: Responding to the S-II Resident Manager's request for appraisal of possible Tulsa/Seal Beach consolidation, if reduced production schedule caused uneconomic retention of labor at Seal Beach, Mr. J. Franklin and Mr. E. Bryan of ME Laboratory compiled data and analyzed manufacturing plans at Tulsa and Seal Beach for detail study of retrenchment planning.



## NOTES 5-20-68 LUCAS

1. MDA RECONFIGURATION: As a result of the 5-15-68 presentations to Mr. Luskin and follow-on agreement with I-S/AA, we are proceeding as follows: (1) Delete docking ports 2 and 3; (2) Delete all conical section windows and associated mechanisms; (3) Remove scientific airlock over docking port 1; (4) Add a docking window (12" x 17") forward of port 1; (5) Interior layouts for medical experiments shall allocate space for a waste collection system. The following actions are to be initiated immediately: (1) Revise MDA end item specification in accordance with the above design requirements; (2) All design elements, including structural, assembly, electrical, and instrumentation, are to revise their design and documentation in accordance with these new requirements; (3) The structural test article is to be manufactured in accordance with the subject additions and deletions; (4) The MDA engineering mockup is to be updated to reflect these new requirements; (5) Crew Station Review and associated simulation planning is to be initiated to include the above design requirements. Revised MDA schedules will be issued no later than 5-22-68.

2. ATM CONTROL AND DISPLAY (C&D) PANEL OPERATIONS: A human factors demonstration of the ATM C&D dynamic simulation was conducted in the Computation Laboratory on 5-15-68, with astronauts Gibson and Garriot participating. The purpose of this simulation was to evaluate the integrated C&D panel operations of manual gravity gradient momentum dump together with experiment panel operations and experiment pointing tasks. This initial simulation was a major milestone accomplishment since it provided the first opportunity for the crew to actually perform ATM C&D panel operations. We now have the first demonstrated confidence that the present panel layout will satisfy the Principal Investigator's experiment data requirements for normal operations; however, extensive verification simulations will be required including off-nominal operations.

3. S-II LIGHTWEIGHT THRUST STRUCTURE ASSEMBLY TEST ("C" STRUCTURE 403) FOR S-II-4 AND SUBS: On 4-11-68, the first ultimate test on the thrust structure resulted in a buckling failure of the center engine cross beam shear web. You saw the damaged hardware in building 4619. A fix recommended by North American Rockwell (NAR) was installed by R-ME. The test was repeated last week. All data appeared normal and no failures were observed in a quick-look evaluation. A comprehensive post-test inspection has begun. The next ultimate test is planned for 5-21-68.

4. POGO WORKING GROUP: The analysis and tests are on schedule as described to you last week. We expect two key people from Aerospace to begin working with us (at MSFC) tomorrow. A senior representative from Grumman is also expected this week. We still do not have a resident representative from MSC.

NOTES 5/20/68 MAUS

No Comments.

NOTES 5/20/68 RICHARD

No submission this week.



## NOTES 5/20/68 SPEER

1. ATM FLIGHT OPERATIONS REVIEW: We held our first ATM Flight Operations Review this past week with representatives from ASTR, P&VE, and MSC's Flight Operations Directorate. This review covered both the identification and usage specification of flight control measurements and ground commands. With the crew operations interface now being defined by the baselining of the ATM Control and Display Panel, the division of responsibility between crew and ground is now better recognized and seems to be workable. Our individual system flight control requirements will be submitted to ASTR within the next two weeks.

2. HOSC: MSC (Chris Kraft) has requested that R-COMP transfer our present HOSC digital TV display system to MSC for their Apollo Lunar Surface Experiments Package (ALSEP) support facility. COMP is in the process of procuring our second generation display system which will be operational in January 1969. It appears that we should agree to provide these surplus machines to MSC after the new HOSC display system has become completely operational. -General Bogart has signed our backup power and backup air conditioning projects for the HOSC.

3. AIRCRAFT OPERATIONS GROUP: This group, which is concerned with our Apollo Range Instrumentation Aircraft (ARIA), met during the last week with representatives of my office participating. Significant items of discussion: (1) Performance of ARIA during AS-502 (MSFC's evaluation as reflected in the meeting reports is the more comprehensive of all concerned Centers); (2) Mission requirements for AS-205 (ARIA will provide support for manual crew control and support in full force during S/C re-entry and recovery); (3) Definition of the translunar injection phase (we are stressing the need for full utilization of all possible facilities to cover some portion of pre-ignition sequencing as well as second burn, which is presently guaranteed).

## NOTES 5-20-68 Stuhlinger

1. ATM FOLLOW-ON STUDY: The X-ray and gamma ray experiment proposals which received high priority ratings in the recent Astronomy Subcommittee meeting in Houston are being reviewed. They will be the experiments considered for the high energy portion of the ATM follow-on study effort. These experiment proposals are currently being summarized to present in a uniform, easily referred-to manner, the basic information needed by mission planners and payload designers.
2. NUCLEAR-ELECTRIC SPACE POWER: A meeting was held between members of ASTR, ASO, EO, and SSL to discuss the future of space power programs at MSFC. Dr. Haeussermann indicated that he expected to reduce or terminate R&D on fuel cells and batteries and begin to concentrate on nuclear reactor systems.

SSL presented a suggested long range program plan for Marshall that relates desired study to a parallel program of hardware development. The basis of the plan is the near term use of the zirconium hydride reactor (SNAP 8 reactor) with thermo-electric conversion, and the development of a lighter thermionic reactor power system for the longer range program objectives.

It was generally agreed that the studies suggested were appropriate. SSL is presently working on a more detailed study and development plan.

3. METEOROID SIMULATION: The light gas gun in SSL can now launch 0.1 gm Lexan projectiles at approximately 7.5 km/sec. This is equivalent energy-wise to a 0.01 gm meteoroid at 23.7 km/sec. Such meteoroids will be encountered near earth at the rate of  $.00000018/m^2$  day. A  $150 m^2$  OWS will average 37,250 days between encounters of such meteoroids. In one year the probability of encounter is 0.01. In other words, protection against such meteoroids is required to obtain a survival probability of greater than 0.99 for a one year mission of OWS.

By using an Al projectile and achieving a velocity of 7.0 km/sec, we can simulate meteoroids of 0.02 gm. The probability of encounter of a meteoroid of this mass in a one year mission of OWS is 0.0038. Therefore, it is now within our capability to simulate energy-wise the mass of meteoroids that must be defeated by the bumper to give OWS a greater than 0.996 survival probability for one year.

## NOTES 5/20/68 TEIR

SA-205 LAUNCH VEHICLE DCR ACTION ITEMS: A total of eleven action items were assigned at the DCR. Responsibility for all of these items has been assigned to specific laboratories or individuals for completion of action by the designated reporting dates. The most significant is the S-IVB propellant tank proof pressure test action item. R-P&VE and MDC have the action and we will be reporting to the DCR Board on this item in Washington, D.C., on Thursday, May 23, 1968.

G. E. ESE SINGLE POINT FAILURE ANALYSIS: Reference is made to Dr. Debus' letter to you dated April 30, 1968 (copy attached) urging that your personal attention be given to single failure point analysis of launch site ground support equipment. We have had actions underway for some time to identify and analyze potential single failure points in critical circuits containing components that may change state between ignition and liftoff. We have identified fourteen potential single failure points which could possibly cause a scrub after ignition. We have not found any potential single failure points in this category which would cause loss of vehicle or loss of life. The next phase in our single point failure approach will be to have G. E. examine circuits which have components that do not change state, but which depend upon an electrical voltage or current to keep them in their steady state condition. G. E. is also preparing a control schematic due for completion May 22, 1968, for critical ESE circuits. This document will be used to examine any future changes to the critical circuits and an "on the spot" single point failure analysis will be made if such changes are considered.

We are working with G. E. to develop a logical plan for continuing our single point failure analysis with the objective or progressively correcting the most critical weak points first.



## NOTES 5-20-68 WILLIAMS

### 1. Extension of Manned Space Flight Capability (EMSFC) Working Group:

As a result of Chuck Mathews' recent request for independent Center studies and recommendations for earth orbital programs, we have been receiving similar requests from the various subpanels of the EMSFC (Lord's group). We have informed the various subpanel chairmen (Maggin - Goals and Objectives; and Howard - Program Options) that, as a result of our inability to work all requests simultaneously, our emphasis will be on supporting the Mathews request which is being worked by Dr. Dixon. It is also our understanding that the MSF input to the Newell EMSFC panel will be based on the Mathews study.

2. Lunar Working Group - Single Site Sub-Group: The "single-site" sub-group to the Lunar Working Group met at Goddard during May 13-15, 1968. Mr. Dave Paul and Mr. James Belew attended for MSFC. This concept of a lunar program, structured around multiple revisits of a single-site, was suggested by Newell and the PSG as a credible alternative to the multi-site philosophy heretofore considered effective. The sub-group with representation from OMSF, OART, MSC, MSFC, LRD, GSFC and Bellcomm, re-analyzed the principle issues, objectives, goals, and special studies from the standpoint of the single-site concept. Several advantages of this approach were defined (stockpiling, re-use, enhanced scientific "depth" etc.); however, the group has been asked to contrast the contending schemes. It is felt that they would recommend keeping the current approach rather than changing.

May 27, 1968

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NOTES  
MR. GORMAN'S COPY  
MAY 27 1968

*Without comments*



## NOTES 5/27/68 BALCH

S-II-3 - Cryogenic proof pressure test has been rescheduled from 5/30/68 to 5/29/68.

S-II-5 - LH<sub>2</sub> flight vent valves have been installed. S-II-5 activities are currently limited to minor tests and modifications because of priority being given to the S-II-3 stage.

S-II-6 - Stage is still expected to arrive at MTF from Seal Beach on 6/9/68.

S-IC-6 - Stage automatic procedures are being verified against the Ground Equipment Test Set (GETS) and are being revised as necessary.

Legal Affairs - NASA Headquarters has requested that we furnish to the U. S. Attorney for the Southern District of Mississippi copies of an investigative report and other information relating to the three Rester suits for damages from the S-IC-5 static firing at MTF on 8/25/67. By copy of a letter from the Department of Justice to NASA Headquarters, additional information has been requested concerning whether there are other claims arising out of the same activity which will probably result in law suits.

To date, a total of 14 formal claims for damages from static firings have been filed. Of these, 13 have been denied, and one is still pending. The shipments on 4 of the 13 that have been denied have filed suits against the Government. On 6 of the 13, the claimants are barred from filing suits because 6 months have elapsed since denial of their claims. On the remaining 3 of the 13, the claimants on 2 have until 7/22/68 and the claimant on 1 has until 10/17/68 to file suits if they so desire.

Transfer of Key Employee - Mr. John E. Sharkey, Chief of my Contracts Management Office, is transferring to the National Institute of Health at Bethesda, Maryland, Friday, 5/24/68, was his last day of duty at MTF.

CONTROL AND DISPLAY DESIGN STATUS: A joint meeting with MSC, MSFC, and MDC was held on April 10 to discuss the new MDC Workshop control and display panels. By the end of May, after comments by MSC, MSFC should be able to direct MDC to proceed with detail design of the control and display panels.

AAP-2, 3A EXPERIMENTS PHOTOGRAPHIC REQUIREMENTS: A meeting was conducted at MSC on May 17, to discuss experiments photographic requirements. The MSC AAP office coordinated the meeting. The Crew Systems Division presented present, planned and possible future camera capabilities. Experiment P.I.'s or their representatives presented photographic requirements. The MSC AAP office will evaluate requirements versus capabilities and, where appropriate, direct the Crew Systems Division to increase camera capabilities to better accommodate experiments.

ATM FOLLOW-ON STUDIES: After discussion with Dr. Goldberg, Mr. Jesse Mitchell, OSSA, has provided the following guidance for the ATM follow-on studies: OSSA to put emphasis on a solar experiment complement for ATM-B and on gamma ray and X-ray stellar experiments (unsolicited EMR-II experiments). The stellar one meter UV telescope is more likely to become a candidate for unmanned OAO type missions. The solar package which appears to be OSSA's present choice to fly in 1972-73 time frame consists of four experiments: the two advanced ATM experiments - NRL S053 and HCO S055; California Institute of Technology - Photoheliograph; and Massachusetts Institute of Technology and American Science & Engineering - Twenty inch Focusing X-ray Telescope.

EXPERIMENT MEETINGS: The T020, Jet Shoes (Foot Control Maneuvering Unit), Integration and Planning Meeting was conducted at MSFC on May 23. The Principal Investigator and pertinent organizations from the MSFC were represented for the meeting. This was the last of the planned meetings for AAP-2 experiments being integrated by MSFC.

EXPERIMENT POINTING SYSTEM CRITICAL DESIGN REVIEW (CDR):

A CDR with Perkin-Elmer on the ATM experiment pointing system was conducted on May 23-24. Some areas of structural interference were identified; however, it appears this can be corrected relatively easy and the system will now be under Configuration Change Board control

ATM PROJECT STATUS REVIEW: An ATM Project Status Review was held on May 21 at MSFC, with attendance from MSC, KSC, LaRC and Headquarters (MSF and OSSA). The review showed satisfactory overall ATM progress, with design complete in many areas and some development hardware undergoing tests. The area of most concern was shown to be timely approval of hardware procurements.

## NOTES 5-27-68 BROWN

F-1 ENGINE - POGO - The initial six tests to evaluate helium injection using F-1 engine F-4028 at the Edwards Rocket Engine Test Site (RETS) have been completed. Helium was injected into the LOX pump inlet at rates of 1/2 to 2 percent. Excessive gas generator oscillations occurred during four of the six tests. On one test oscillations reached 375 psi peak to peak (present spec. limit: 150 psi peak to peak). To evaluate the possibility of suppressing these oscillations by increasing G.G. flow, two of the tests were conducted with gas generator flow rates of 10-14 lb/sec above those expected for AS-503. Only minor suppression was noted. Though the above results do not give the helium injection a "clean bill of health" they do not completely eliminate it either. Rather, it now looks like we have a situation in which engine operating risks will have to be traded off against overall vehicle risks.

THRUST DECAY - Preliminary results of "soft" F-1 engine shutdown show promise of meeting the criteria of 415K pounds decay per 75 ms at -3 Sigma in the region from 100% to 40% thrust. Decay rates obtained from 40% to 10% must be evaluated further.

J-2 ENGINE - The flight configuration augmented spark igniter (ASI) with redesigned ASI fuel and LOX lines were shipped from Rocketdyne to AEDC on May 26, 1968. The S-II Battleship will receive ASIs May 29, 1968.

Failures have been induced (after approx. 60 seconds) in two single ply fuel line bellows sections under flow conditions simulating those on AS-502. All previous failures have required conditions of greater flow than those experienced in engine operation. The failures occurred while the lines were under hard vacuum conditions and infer that at sea level or even at simulated 100,000 ft. altitude conditions, frost and/or liquid air may be trapped under the wire braid and damp flow induced vibrations. This has been the first clue as to the "why" of the failures on 502. An improved test setup has been established to further investigate this theory.

The J-2 engine component manipulator for S-IVB applications was demonstrated at KSC on S-IVB 500F during the past four-week period. The demonstration proved interface compatibility and a positive means of removing heavy engine components when the engine is in a stacked stage. A critique is planned by the MSFC/S-IVB Office at KSC next month on the utilization of this GSE. The manipulator had previously been demonstrated for S-II applications on the Electro Mechanical Mockup at Downey.



NOTES 5/27/68 CONSTAN

Negative

NOTES 5/27/68 FELLOWS

Negative Report

1. Earth Resource Experiments: A study has been undertaken to determine the compatibility impact of adding seven earth resource experiments into the AAP-1/2 mission. Total times over the USA were determined for both 29° and 35° inclined orbits at 220 n.mi. altitude. A launch time of late afternoon afforded the maximum number of daylight passes ( $\approx 60\%$ ). Integrating the over-USA opportunities into the present AAP-1/2 timeline reduced the available non-automatic experiment performance time to approximately 48 passes, or 8 hours. Work is continuing with respect to (1) variation of the basic crew duty cycle in conjunction with MSC, (2) more detailed impact of the earth resources on the biomed experiments, and (3) integration of the USA cloud cover probabilities.
2. Support to Sentinel Systems Command: Aero-Astroynamics Laboratory personnel have been assisting local Army Sentinel Systems Command (SENSCOM) personnel on problems concerned with upper atmospheric wind measurements. Mr. J. Allen (SENSCOM) is responsible for determining whether there is a bias in their rawinsonde measured upper atmosphere winds acquired at Kwajalein Island. Our Aerospace Environment Division has provided SENSCOM available information on the accuracy of rawinsonde wind data. However, to help resolve the problem, we plan to provide some Jimsphere balloons to be tracked by the Army at Kwajalein Island, so they can make a comparison of Jimsphere and their rawinsonde wind measurement data. This was a small effort on our part with the Army, and will further the utility of the Marshall developed Jimsphere.
3. Saturn V Aerodynamic Changes: Preliminary analysis of AS-502 flight data indicates a 25 percent decrease in axial force from the established design values. About 15 percent of this decrease is due to scoop removal. The remaining 10 percent decrease is due to differences in flight measurements and wind tunnel measurements. These percentages were computed near maximum dynamic pressure, however, the overall effect on vehicle performance will be an increase in payload to escape of approximately 400 pounds. AS-502 flight data also indicates a large region of plume induced flow separation on the first stage near the end of first stage flight. This plume induced separation shifts the center of pressure forward and reduces the normal force coefficient since the aerodynamic loads on the S-IC stage, fins, and shrouds are reduced to near zero. The change is of no practical significance because the aerodynamic loads in this region (Mach 4 to 7) are very low due to the decreasing dynamic pressure.
4. Manpower: Dr. Robert W. Gunderson, an outstanding mathematician from our Astroynamics and Guidance Theory Division, has accepted a teaching position at the University of Utah. He will leave MSFC in August.



1. ATM TESTING: Analysis of two configurations of ATM panels has been completed. To date, 1750 have been inspected which includes experimental, test, and flight panels. Defects caused by handling and manufacturing error were high at the beginning but improved steadily as the program progressed. At the beginning of tests, rejects averaged 34 percent, but with improved manufacturing techniques, handling, and protective covers, the reject rate was decreased to 8 percent.
2. S-II VALVE CASTING DEFECTS: During vibration qualification testing of a pre valve, the actuator housing broke off from the main valve body. Failure analysis indicated that the failure initiated from a "cold shut" casting defect. Further analysis as to what caused the "cold shut" indicated it probably was caused by the use of a casting compound which was placed inside the mold to eliminate or reduce the parting line image on the casting. As a result of this problem, an inspection was made of 17 pre valves and fill and drain valves at MTF. This inspection disclosed that 14 of these valves had surface defects or indications of "cold shuts". An investigation is being conducted to locate all pre valves and fill and drain valves that have these type of surface defects and where possible grind out the defects within limits established by Material Review Disposition (MRD). Also, it must be determined why NR accepted these valve castings with surface defects.

1. Astrionics Support for Army Design Reviews. Astrionics was requested to support the Army MICOM design review for the SAM-D\*Data Processing System by providing a member to the design review committee. The committee's functions and actions entailed one week of technical briefings at MICOM, one week of presentations at the contractor's facility in Boston, and one week of preparation and writing the final report to General Eifler. Roughly, one man month was devoted to the project. General Eifler has indicated that he would like to see the reviews continue on a more or less periodic basis, the next review being contemplated in November. If the design reviews continue, it is very likely that MSFC will be requested to provide continuing support. We will not participate further without additional MSFC management approval.

2. ATM Quarterly Review. The ATM quarterly review was held May 21 at MSFC. Participants included Messrs. Luskin, Mitchell and Forsythe from Headquarters and Dr. Giacioni, Dr. Newkirk and representatives from the other Principal Investigators. Some of the significant points which were discussed included:

a. Headquarters personnel brought up the subject of solar array deployment and the impact of a failure of the deployment system. The deployment system is electrically redundant with the design goal to eliminate all single point failures. An exception to this is that the mechanical drive is a single point of failure. We believe by thorough ground testing the reliability and confidence level of the deployment scheme can be demonstrated without having to resort to the complexity of making the mechanical elements redundant.

b. Dr. Newkirk questioned the test program for the fine sun sensor with respect to the ability to test it on the ground versus operating beyond the disturbing atmosphere. He suggested using some small rocket or balloon flight tests. We have recognized this problem and have been considering tests at some high altitude observatory (e.g., Kitt Peak Observatory) to get a better assessment of the sensor and the effects of the atmosphere. We have also been considering an orbiting flight test but have not come to any definite conclusions at this time as to the need for such a test or the means of implementation.

c. Several times the question of actions due from Headquarters came up. These included procurement actions, decision on the ATM TV downlink, the teleprinter and ACE at MSFC.

The review was a productive effort and the above stated areas plus others are being worked by the cognizant organizations.

\*MICOM - Army Missile Command

\*SAM-D - "D" configuration for the surface to air missile system

NOTES 5/27/68 HEIMBURG

F-I TURBOPUMP POGO TESTING Four F-I Turbopump POGO tests were successfully conducted last week. Tests were run at LOX pump inlet pressures of 100 psia and 130 psia using a Whittaker LOX pre valve. Various conditions were tested, such as: (1) all gas bled from the LOX pre valve cavity, (2) helium injection into the LOX pre valve cavity, (3) gaseous oxygen injection into the pre valve cavity. Preliminary data indicate helium injection into the pre valve cavity is an effective method to suppress POGO; however, gox injection into the pre valve cavity does not appear to be an effective method. The test program originally established for the first F-I Turbopump has been completed. P&VE is to let us know today if additional tests are required on the first pump. If not, we will start change-out for the second pump this week.

F-I ENGINE Test FW-082 was conducted on the West Area F-I Test Stand on May 22, 1968, with F-I engine S/N F-5038-1 for a mainstage duration of 147 seconds. The test was terminated by the facility panel operator upon completion of test objectives. This was the third of a series of tests to evaluate the helium injection on engine performance. The engine was gimballed at 5.0 c.p.s. and  $\pm 0.25^\circ$  (pitch actuator only) from X+135 seconds to cutoff to determine the extent of LOX system oscillations that can be induced by gimbaling. Data from the tests are being evaluated. A modified S-1C LOX pre valve will be installed in the West Area F-I Test Stand prior to the next test to investigate utilization of the LOX pre valve cavity as an accumulator for another potential POGO fix.

MODERATE DEPTH LUNAR DRILL Dr. J. Hanley visited with R-TEST-SP on May 23, 1968. He seemed pleased with the progress which is being made toward obtaining contracts with Northrop and Westinghouse. Both companies should be under contract before the second week in June 1968. Telephone conversation with Joy Manufacturing Company indicated that the ball spline (a critical component in their hammer design) as yet has not been delivered. They hinted at a future extension of their contract, at no cost to the government, to allow them additional in-house test time.

S-II STRUCTURAL TEST PROGRAM The LN<sub>2</sub> cold shock is scheduled for May 27 and 28, 1968.

S-II-3 (MTF) S-II-3 is installed in the A-2 Test Stand at MTF. Final checkouts and preparations for the cryogenic proof pressure test are underway. The test is now scheduled for May 29, 1968.

S-II-5 (MTF) S-II-5 is installed in the A-1 Test Stand at MTF. Pre-static checkouts and modifications are now in process. The static firing will be delayed in order to incorporate the new ASI lines.



## NOTES 5-27-68 HOELZER

### 1. ACCEPTANCE TESTING OF THIRD GENERATION COMPUTER SYSTEM:

Acceptance was resumed Tuesday, May 21, 1968. Considerable success has been achieved which gives rise to guarded optimism toward successful acceptance of Phase I in 30 days. Stability of the Executive VIII System has been greatly enhanced. Numerous errors, both serious and trivial, have been removed.

2. "FIRST GENERATION" TEXT EDITING SYSTEM: We have an effort underway to define technical specifications for a "First Generation" text-editing system on the UNIVAC 1108 computers. This system should permit the alteration, insertion, and deletion of typewritten text (for reports and other typewritten documents) through the remote teletype and cathode ray scope terminals attached to the 1108's. It should be similar to the magnetic tape text-editing systems which IBM sells but it should be more versatile because of the flexibility and storage capacity of the 1108's.

3. VISIT BY JPL ADVANCED PLANNING PERSONNEL: Dr. Thorman and Mr. Lesh of Jet Propulsion Laboratory, Advanced Planning and Engineering Systems Division, visited us and we discussed our work on digital simulation of large physical systems for R-QUAL and R-ASTR. Both gentlemen were very much interested in our developments of simulation systems, particularly since JPL will also shortly install a time-sharing multi-processor UNIVAC 1108 computer system. JPL is planning a large simulation system to simulate their world-wide tracking system, including the dynamics of the spacecraft. They considered our Marshall System for Aerospace Systems Simulation (MARSYAS) development very attractive and would like to cooperate closely with us during the implementation of MARSYAS.

NOTES 5/27/68 JAMES

1. S-IVB Stage Cryogenic Proof Testing: At the special DCR Board Meeting on May 23, 1968, it was determined that if Saturn V S-IVB LH<sub>2</sub> ullage pressures are reduced 2 psi, then present ground testing methods are adequate verification of the hardware and cryogenic proof testing will not be required. The pressure reduction will be accomplished by resetting presently qualified Saturn V valves; therefore, the decision has practically no impact to the Saturn V Program. Additional information on the Saturn IB aspect is contained in Colonel Teir's notes.

2. Failure of S-II Thrust Structure Test Article ("C" Structure): The "C" structure failure that occurred Tuesday, May 21, 1968, was major. The lower inner and outer cap rings of the thrust structure were broken as well as stiffeners and several rivets. The failure occurred around the engine block area.

The test article has been subjected to a heavy workout while qualifying it for all possible anomalies. This article has been loaded beyond limit conditions five times; in addition two ultimate tests have been completed. These tests verified that the thrust structure is qualified for normal flight conditions. The remaining two ultimate tests were to qualify the structure under one engine out condition. The failure occurred at 124% of limit load conditions on the third test (130% was the required loading). Fatigue is being investigated as one of the possible causes of the failure. P&VE and NR are reviewing the test data to verify the degree of qualification for the engine out condition, determining the repairs necessary for the continued testing of the "C" structure and determining design fixes for flight vehicles based on the failure. The analysis of the failure has indicated a rivet material problem may exist in the same area on S-II-3. If this is the case, a number of rivets may have to be replaced on S-II-3.

3. S-IC Engine Canting: An MSF review of the spacecraft load capability indicated the SM/CM interface (on AS-504 and subs) cannot take the bending moment introduced during an F-1 control engine shutdown. It will, therefore, be necessary to cant the control engines 2° from T+15 seconds through S-IC cut-off, and we plan to implement this canting on AS-503. Canting will sacrifice approximately 180 pounds payload capability; however, it will alleviate part of the detrimental POGO effects. IBM is optimistic that the change to the Flight Control Computer (with minor changes to the networks and software) can be incorporated without slip to the AS-503 schedule.

4. S-II-3 Stage: The S-II-3 Stage is in the test stand at MTF and preparations are underway to cryogenic proof pressure test the stage on Wednesday, May 29, 1968.

5. POGO: Dr. Ralph Lanzkron has been assigned as the overall POGO Manager at MSC; and Major Charles Duke (Astronaut) has been assigned as the MSC representative on the MSFC POGO Working Group. Major Duke is located in the P&VE Laboratory.

## NOTES 5/27/68 JOHNSON

OART FY 70 Planning Cycle: - This item was reported in my notes of April 29 and May 13. Guidelines from OART needed to evaluate overall OART plans are now expected May 27. With the Advanced Research and Technology Board meeting now planned for early July we will have three to four weeks to develop MSFC's response.

Gravity Substitute Workbench Experiment - This experiment is now proceeding through development as a potential Saturn I workshop experiment. It is currently proposed, and being developed, to test independently the effects of two methods of deriving a force field to induce "settling" of components on a workbench in "0" G flight. The first method will utilize the force produced by a relatively low velocity, directed air stream; the second, by electrical fields. The work space, measuring and recording equipments for both experiments are common. The experimental protocols are quite similar. Therefore, the two tests are being treated as a single experiment. Preparation of experiment integration documentation is in progress. AERO, ME and Chrysler are teamed to produce the experimental hardware and experiment documentation.



NOTES 5-27-68 KUERS

Development of Welding Technology: The ME Laboratory has systematically for several years pursued the study of welding problems in-house, at technical institutes, and industry. Since 1964, 20 of such interrelated studies of welding parameters and problems have been conducted. The reports from the studies have been widely disseminated to our Saturn/Apollo contractors and have been utilized in the applied welding techniques; for instance, in contamination control and cleaning techniques. Last year we had the first 10 studies integrated into one single report by Dr. Masubuchi of the Battelle Institute. Dr. Masubuchi gave a paper, based on this integration report, to the Aluminum Wire Association, which organization is now going to present to Dr. Masubuchi an "Honorary Award" for significant contribution to the welding community. This week, Dr. Masubuchi repeated the presentation at the Inter-American Metallurgy Conference, which will have wide distribution in the Spanish and English languages. The same subject will be presented at the International Welding Conference next year in Japan.

1. S-II "C" STRUCTURE TEST (THRUST STRUCTURE FOR S-II-4 & SUBS): On 5-21-68, the ultimate load condition with one outboard engine out was aborted at approximately 120% load because of an extensive failure at engine No. 3 location. A team is analyzing and evaluating the failure. Since the S-II-3 (high-force) thrust structure survived the same ultimate load case (one engine out, 3 engines @ 7.7<sup>0</sup>) that failed the S-II-4 thrust structure, a detailed inspection and comparison of the two specimens is being accomplished. Preliminary results indicate that fasteners of higher strength were used in the ground test articles (high-force, facilities and structural) than on flight stages in the main thrust area. Because of an anticipated problem at flight elevated temperatures, original fasteners were exchanged for fasteners more suitable for elevated temperature, however the high temperature fasteners have lower strength. It has been concluded because of this difference of fasteners that the S-II-3 (high-force) specimen might have also failed if flight-type fasteners had been installed. All flight stages will have these fasteners replaced, starting with S-II-3. This is not a major rework and can probably be accomplished on S-II-3 when the ASI mods are installed.
2. WASTE MANAGEMENT: We invited representatives of Republic Aviation Division of Fairchild Hiller to brief us on the work they have done in the area of waste management. Information presented was generated under Air Force contracts and included actual hardware development experience. Republic has an Air Force contract to develop a system for MOL. Preliminary observation indicates that a system such as the Republic system could be integrated into the Orbital Workshop (OWS) and, for certain waste management functions, components of the system could be integrated in the Multiple Docking Adapter (MDA). In both instances, the arrangement appears compatible with the AAP Biomedical Experiments. Republic answered a MSC request for proposal for a system for OWS a year ago but has not been contacted further by MSC. The waste management system on Apollo has been abandoned and MSC is reverting to Gemini hardware for this application.
3. POGO WORKING GROUP: Effective 5-24-68, Astronaut C. Duke was assigned full time to MSFC to represent MSC on POGO Working Group activities. In addition, Aerospace Corporation has designated Dr. S. Rubin and others to serve as resident consultants in this area. Messrs. Baird, Bernstein and Pulgrano of Grumman Aircraft Engineering Corporation spent two days with us at MSFC last week. They took several assignments of work back to Grumman and will return to MSFC in a few days. Stability analysis as related to the two most prominent fixes (helium injection in the LOX feed line and LOX pre-valve cavity accumulator) is continuing. Preliminary stability analysis for AS-503 without a fix indicates marginal stability from 80 to 140 seconds of S-IC boost. The test program is on schedule.
4. WIDE TEMPERATURE RANGE ADHESIVE: Monsanto Research Corporation working under contract NAS8-20406 has made a significant breakthrough in the development of an adhesive effective over a wide temperature range. By blending two polymers with a commercially available catalyst, a urethane adhesive resulted that is comparable in strength to Narmco 7343 at cryogenic temperatures but is at least twice as strong at room temperature and four times as strong at 150<sup>0</sup>C as the 7343 adhesive. The two polymers are unattractive when reacted individually with the catalyst, but blending offers an analog to a metal alloy which has not been widely studied.

TDY SUPPORT TO KSC - Our representative visited KSC last week and discussed with Dr. Gruene, Director of Launch Vehicle Operations, the phasedown of Marshall TDY Support. The decision reached on AS-503, coupled with Dr. Gruene's hiring of 63 permanent employees since inception of the TDY Support program, makes it possible to phase the MSFC personnel back to Huntsville somewhat earlier than originally planned. The program peaked at 49 in March 1968; 19 of these have already been returned to Marshall and we expect to have 28 on board at KSC at the end of May. Of those, 10 will return in June, 16 in July, and 2 in August to complete the program. Dr. Gruene has expressed considerable satisfaction with the program and is, in many cases, writing to the Lab Directors advising them of their employees' contributions, areas of involvement, and generally expressing his satisfaction. Interviews of the MSFC employees indicate that they are being well utilized on Apollo-related work and are operating very well within the KSC organizations to which they are assigned. We plan to prepare a final report on the program which will be available for presentation in late July.

AAP INTERIM OPERATING PLAN - A request by Dr. Mueller for an interim operating plan for AAP requirements through December 1968 is expected to be received early next week. This will be an urgent action with an extremely tight deadline, June 3, 1968. The AAP plan assumes no new FY-69 obligation authority available prior to December 31, 1968. Centers will plan to operate within the \$253.2M limits of FY 1968 program authority through December 1968 of which planned allocation to MSFC is \$146.9M. Centers will also plan to achieve maximum obligation of FY 1968 funds by June 30th, providing for requirements outlined through December. The plan assumes equal appropriations (\$253.2M) for FY 1968 and FY 1969. The FY 1969 planned amount will support requirements through June 1969. The program content includes continued fabrication and assembly of Saturn IB's and V's at the rate of two per year in accordance with the newly approved M(P)-7 delivery schedule. Preliminary (unsigned) copies of the guidelines and instructions for this submission were received Thursday and distributed to I. O.'s Resources Management and Apollo Applications Offices.



NOTES 5/27/68 RICHARD

No submission this week.

## NOTES 5/27/68 SPEER

1. ALSEP GROUND CONTROL: Immediately following the first manned lunar landing, the Apollo Lunar Surface Experiment Package (ALSEP) will require a limited ground support for extended periods of time. A total of three ALSEP's are expected to be flown, the first one possibly as early as May 69. Length of ground support is estimated in the order of 30 months. MSC had submitted a detailed proposal resulting in rather high cost for modifications to the MCC Network Staff Support Room (two IBM-360 computers and two M. dollars). -In a surprise move last week, General Stevenson has rejected the MSC proposal because of its excessive costs and opened this project to the lowest bidder. The following Centers (and respective operations facilities) have been invited. GSFC (Goddard Satellite Control Center), JPL (Space Flight Operations Facility), KSC (Central Instrumentation Facility) and MSFC (Huntsville Operations Support Center). MSC (MCC) is included again and may be forced to revise the original proposal. Although much will depend on MSC's position, OMSF appears to be serious in considering these other facilities in order to lower cost and gain a high degree of independence from Apollo related flight control tasks. I have initiated priority actions to perform a quick evaluation of all factors pertinent to an MSFC position and will be prepared to brief you on our recommendation prior to June 5 when MSFC's answer is due at OMSF.

## NOTES 5-27-68 Stuhlinger

1. VISIT AT YERKES ASTRONOMICAL OBSERVATORY: Gerhard Heller and I spent a full day at Yerkes as guests of the observatory director, Dr. O'Dell. We were greatly impressed by the highly efficient operations of the scientific and technical staff. Dr. O'Dell, as a member of the Goldberg Astronomy Missions Board, stated that MSFC is expected to play a very significant role in future space astronomy projects. He expressed the hope that NASA would soon proceed to establish an astronomy program with clearly defined, challenging, and ambitious projects that include manned systems. I am sure that Dr. O'Dell's membership in Dr. von Braun's scientific consultants group will prove very beneficial for MSFC.
2. IN-HOUSE ATM CONTAMINATION TESTS: This past week samples were irradiated in an oil vacuum chamber using infrared radiation in a test similar to other tests in which UV radiation was used. The IR irradiation caused no measurable damage in the same length of time that UV (of the same total intensity) caused 10-14 percent change in reflectance. This test was to demonstrate to the ATM Project Office the damaging effect of the ultraviolet in the solar spectrum where infrared radiation of the same intensity causes no damage.
3. CONVAIR 990 EXPERIMENT: Due to the unsuccessful Nimbus D mission, current meteorological flights of the Convair 990 will be completed earlier than expected. According to Mr. Louis Haney of Ames Research Center, the solar flights which will include the SSL heliometer of Roger Linton may begin as early as July 1, rather than July 22 as was scheduled. As of the present, all parts of the experiment have been tested and found to be functional. However, due to the sensitive nature of the heliometer electronics, some of these tests will have to be repeated at Ames to re-calibrate the instrument.
4. LECTURE ON CURRENT VENUS RESEARCH: Dr. Hale gave the Honors Day Lecture, May 21, to Physics majors and the Physics Department faculty of the University of Tennessee, on Venus.



S-IVB PROOF PRESSURE TESTING: SA-205 DCR action item 9 on S-IVB proof pressure testing was reported to the DCR Board in Washington on Thursday, May 23, 1968. Mr. Ted Smith, MDC, and Dr. Lucas gave the presentations. We presented five different approaches to certify the structural integrity of the S-IVB propellant tanks. These included: justification to "use as is;" perform cryogenic proof pressure test; and three different possible ullage pressure combinations. Advantages and disadvantages of each were presented and MSFC recommended "use as is."

The Board approved a reduction in the ullage pressure of the S-IVB/IB LH<sub>2</sub> tank by 4 psi and in the S-IVB/V LH<sub>2</sub> tank by 2 psi, resulting in the new pressure being the same for each stage. The LH<sub>2</sub> tank pressure reduction is to be accomplished by resetting presently qualified valves. The present S-IVB/V 28 - 31 psi LH<sub>2</sub> burn control pressure switch is to be used on both S-IVB/IB and S-IVB/V stages for prepressurization. The LOX tank pressure will not be changed in either stage. The DCR Board decision applies to all S-IVB stages. The Board also directed us to review all S-IVB-205 tank x-ray films and quality records to assure integrity of the propellant tanks. Gen. Phillips asked that the DCR record reflect what this change constitutes from a "Fracture Mechanics" viewpoint and the rationale for certifying the structural integrity of the propellant tanks with this change. We have requested P&VE to supply this data for forwarding to Gen. Phillips and the DCR Board secretariat.

The Board also stated that if a detailed review and analysis of this change provides any unforeseen problems or undesirable results, or indicates other required action, that such information should be brought to the Board's attention.

This decision should not affect the AS-205 launch date, but will require some expedited action on the S-IVB Stage which already has a considerable amount of scheduled modification work on the launch pad.

G.E. ESE/RCA COMPUTER SPARES COMMONALITY: A comparison has been made between G.E. ESE spares and RCA computer spares to determine the degree of commonality of parts in the present inventories. This evaluation did not include standard parts such as nuts, bolts, screws, lamps, etc. The result of the comparison of G.E. and RCA inventories show that only 6% of their items are common. Based on existing level of spares and projected usage data, combining these common items under one contractor might have saved an estimated \$500.00 per year. This finding confirmed previous overall assessments on this subject. In our judgment this possible savings would not be worth the confusion caused in the field and, therefore, we do not plan to pursue any further actions or studies in this area.

## NOTES 5/27/68 WILLIAMS

1. Special Study Activities (Bill Neighbors' work): We presented to Gen. Smart (+3 others) the results of our work in this area and were very pleased with his reaction. He was surprised at the amount of work which had been accomplished; questioned why this hadn't been brought to Management's attention and concerned that insufficient progress was being made to clarify the picture. He promised action and followed up by arranging a meeting for the next day with Adm. Boone and 8 others (Tischler, V. Johnson, etc.). This meeting was also an eye-opener for those involved and stimulated considerable interest to do something.

Gen. Smart suggested we give a briefing to the June 4 MSF Management Council Meeting as well as to others. Doug Lord has put it on the June 4 agenda for Mueller's consideration. I am making arrangements for other meetings with Newell, Naugle, Rosen, etc. I would appreciate your help in making sure it stays on the MSF agenda.

2. OTES: We have received Program Authority for the \$500K Telescope Technology Program Definition portion of the OTES Program. This is a joint ASO/ASTR activity and will involve other Centers with MSFC being the focal point.

3. Lunar Cargo Delivery System: We have been advised by Col. John Burke, NASA Headquarters, that the Statement of Work for the "Lunar Cargo Delivery System Analysis" has been approved by W. A. Fleming. Normally, this would be the last step on study approval; however, the studies will now be forwarded to Harry Finger for concurrence.

4. Special Launch Vehicle Working Group (Rosen Committee): This group met in Washington on May 20 and 21, 1968. We have now finalized the studies to be accomplished in all areas. These include Saturn IB, V, and Intermediate studies by MSFC, unmanned vehicle studies by LeRC, and launch facility and operations studies by KSC. We have discussed the objectives, approach, assumptions and schedule of the requested studies with I. O. and Executive personnel. A summary was presented to General O'Connor on May 24. We are trying to integrate all the various efforts so as to minimize the workload.